SEPTEMBER

THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION

1935

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Treatment of Paradental Tissues—*Smith*
Prognathic Case—*Walls and Wentworth*
General Anesthesia—*Archer*
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The Journal of the American Dental Association. Vol. XXII, No. 9. Published by the American Dental Association, 212 East Superior Street, Chicago, Ill. Yearly subscription $5.00. Entered as second-class matter, May 1, 1928, at the postoffice at Chicago, Ill., under the act of Aug. 24, 1912. Published monthly.
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THE JOURNAL
of the AMERICAN DENTAL ASSOCIATION

Vol. 22 SEPTEMBER, 1935 No. 9

Original Communications

RELATION OF DIET TO HEALTH*

By AGNES FAY MORGAN, Ph.D., Berkeley, Calif.

FOR the sake of simplicity, the subject of the relation of diet to health may be discussed under three headings: (1) diseases produced by faulty nutrition and treated chiefly or solely by changes in the diet; (2) diseases of unknown cause which are alleviated or cured by dietetic treatment, and (3) some indications of possible positive improvement through nutrition in physical development and maintenance of health beyond that now considered adequate.

The diseases in the first group may be due either to diet deficiency or to some obscure fault in metabolism. The deficiency diseases now recognized are scurvy, rickets, beriberi, pellagra, xerophthalmia, low protein edema, goiter, certain types of anemia and certain digestive disorders such as constipation and diarrhea. Metabolic diseases are chiefly diabetes, gout and possibly certain kinds of arthritis, nephrosis and other rarer conditions. Fever from any cause results in metabolic derangement and should be treated as such.

In the second group lie the whole discouraging array of so-called degenerative diseases of old age: hypertension, arteriosclerosis, heart and kidney failures of various kinds, liver and gallbladder disease, perhaps even cancer and other growths, muscular dystrophy, gastric ulcer, pernicious anemia, sprue, osteomalcia and probably most diseases of the teeth and gums. This is not meant to be a complete list, but is rather illustrative of the number and variety of abnormal conditions which may well be due primarily to faults in nutrition, possibly secondarily at times through disturbances of the endocrine glands. At any rate, these diseases cannot be said to be of infectious origin and must therefore be ascribed to some failure of function. The most encouraging results that have been reported both for the prevention and for the treatment of many of these condi-

*Presented as one of the 1934 popular medical lectures offered by Stanford University School of Medicine, San Francisco, Feb. 9, 1934.

tions have been secured by means of diet.

As better control of infectious disease has been attained, a larger proportion of the population has fallen into the age groups in which these diseases occur, so that now more than 60 per cent of all deaths in the United States are due to these organic diseases. This is incidentally the highest number of deaths from organic diseases shown by any of the countries reporting in the last League of Nations Health Year Book, 1929. It is hard to say whether this means that our dietary habits are especially conducive to these diseases or rather that our sanitarians have been unusually successful in reducing the mortality from infectious diseases.

Fig. 1.—Young dogs of same litter fed low-calcium diet. Dog 188 received 1 gm. of cod liver oil per kilogram a day; Dog 191, no vitamin D. There is extreme deformity of the long bones.

The third group, that involving evidence of a positive improvement by nutrition of supposedly normal health and development, is less easily illustrated. Most of the evidence has been obtained from animal studies, but in recent years there have appeared a number of well-controlled dietary studies on children.

The work of Corry Mann[1] in England and Scotland showed on the addition of milk, butter or green vegetables, remarkable gains in both weight and height in school boys who were supposed to be receiving an adequate diet and to be growing satisfactorily. Bunting,[2] in Michigan, has recently recorded rather extensive dietary studies in orphanages, with astonishing improvement in children, particularly as to teeth, due to supplementing supposedly good diets. We have made a number of limited studies of this kind here and have seen similar results. Even with a most carefully planned basic diet, such as that used in our study[3] at the State School for the Blind in Berkeley, the addition of extra milk or fruit was found to produce measurable increases in the rate of growth of the subjects. A simple change in mode of preparation[4] of vegetables in the same institution was later seen to bring about similar good results. I shall mention in more detail later another of this series of observations.

Only a few days ago, Sherman and Ellis[5] published observations on rats purporting to indicate that a progressive increase in the amounts of vitamin G ingested produces a similar increase in rate of growth over that heretofore accepted

1. Mann, C. H. C.: Diets for Boys During School Age, London: Medical Research Council Special Report Series No. 105, 1926. Orr, J. B.: Milk Consumption and Growth of School Children, Lancet, 1:202 (Jan. 28) 1928.

2. Bunting, R. W., Study of Dental Caries, Science, 78:419, 1933.

3. Morgan, Agnes F.; Hatfield, G. D., and Tanner, M. A.: Effects of Feeding Fruits and Milk on Growth of Children, Am. J. Dis. Child., 32:839 (Dec.) 1926.

4. West, B. B., and Okey, R.: Cost and Nutritional Effect of Making Institutional Diet Palatable, J. Home Econ., 21:254, 1929.

5. Sherman, H. C., and Ellis, L. N.: Necessary Versus Optimal Intake of Vitamin G (B_2), J. Biol. Chem., 104:91 (Jan.) 1934.

in that laboratory as satisfactory. They conclude that the optimum level for vitamin G is probably considerably above that which has been shown to be strictly necessary. These observations were made on large numbers of animals over a considerable portion of the life span and into the second generation. Green and Mellanby[6] have made similar observations on as to protection of teeth and gums, have been shown by Goettsch and Key[7] and others for vitamin C. Thus, guinea-pigs that are protected against all gross signs of scurvy by 1.5 c.c. of orange juice daily as the sole source of vitamin C are found on necropsy to have severe lesions of the dentin. If 3 c.c. of orange juice is given, the teeth are protected.

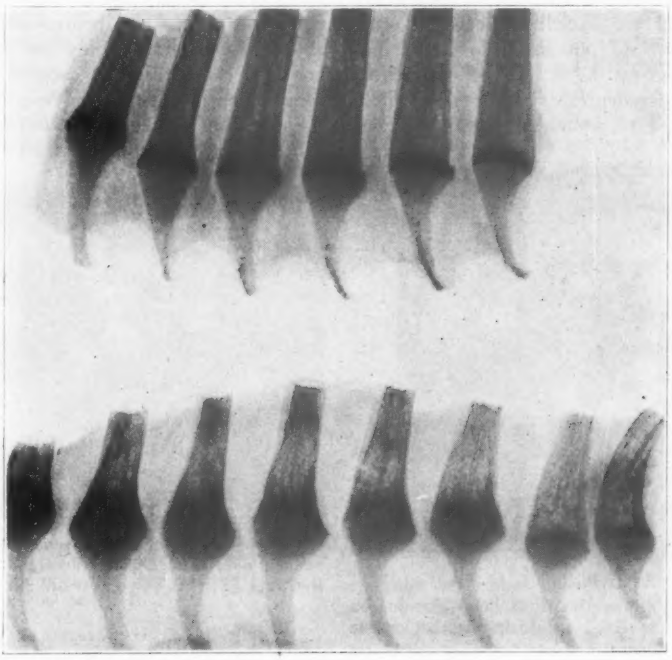

Fig. 2.—Ribs of Dogs 188 and 191. There is superior calcification of the costochondral junctions in the former.

the beneficial effects of increasing vitamin A intake several times beyond that required for apparently normal growth, and somewhat similar results, especially

In our own laboratory, we have found that while this last statement is true for the usual three-months period of the test, when the period is extended to five months or longer 3 c.c. is not enough to

6. Green, H. N., and Mellanby, Edward: Carotene and Vitamin A: Anti-Infective Action of Carotene, Brit. J. Exper. Path., 11:81 (April) 1930.

7. Goettsch, M., and Key, K. M.: Determination of Antiscorbutic Value of Foodstuffs by Höjer's Method, Quart. J. Pharm., 1:168, 1928.

protect the teeth completely and that for protection over a period of a year, at least 6 c.c. must be given. Obviously, the time factor is of importance in this as in most other metabolic disturbances. A slight long-continued deficit may eventually bring about a breaking down of the tissues not seen in shorter tests. Perhaps this is why pyorrhea and other gum and jaw troubles are manifest in middle life only and are so seldom seen in young people. I do not mean to claim that pyorrhea, or, as it is now sometimes called, paradentosis, has been definitely attributed to a lack of vitamin C, but there is a fair amount of evidence of some connection between the two.

Fig. 3.—Two young setters fed adequate diet with strongly acid reaction. The dog on the right received cod liver oil; that on the left did not.

THE DEFICIENCY DISEASES

The true deficiency diseases most frequently seen in this country are probably rickets, anemia and low-grade digestive disorders which are probably due to vitamin B deficiency. All of these conditions occur most often and most severely in young children and in pregnant women.

Rickets.—In 1925, M. M. Eliot[8] found at least mild rickets in 86 per cent of all infants under 1 year of age examined in New Haven, Conn. Hess[9] states, in his classical book on this subject that "a map of the incidence of rickets is the practical equivalent of a map of deficiency of sunlight." But the narrow sunless streets of congested cities everywhere are filled with rickety babies regardless of the homes of sunlight theoretically available. Moreover, not only the amount, but also the ultraviolet content of the sunshine must be considered in evaluating the probable protection afforded by it. For example, a photochemical study made recently in Fresno[10] indicated a low proportion of ultraviolet rays in the very hot, bright abundant sunshine of the summer months. A little more was found in the sunshine on the Santa Barbara beach,

Fig. 4.—Two dogs from same litter, fed neutral diet. The dog on the right received cod liver oil; that on the left did not.

8. Eliot, Martha M.: Control of Rickets, J.A.M.A., 85:656 (Aug. 29) 1925.

9. Hess, A. F.: Rickets, Osteomalacia and Tetany, Philadelphia: Lea & Febiger, 1929, p. 60.

10. Frawley, J. M.: Ultraviolet Light in California Summer Sunshine, Am. J. Dis. Child., 41:751 (April) 1931.

but much more in that measured in the same latitude high up in the Sierra Nevadas. It is probable that similar conditions obtain in the bay region and that dependence on sunshine, even when enough is available, as preventing or curing rickets is not justified. In nearly all parts of this country where biologic tests have been made, the antirachitic value of sunshine has been found to be very low during the winter months, usually rising sharply in March and falling in October.

What then is to be done for those babies of the rickets susceptible age during the winter months and at all times in

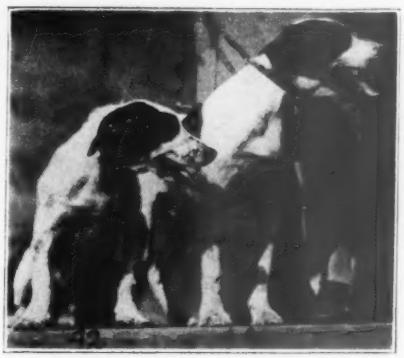

Fig. 5.—Two dogs of same litter fed alkaline diet. The one on the right received cod liver oil; the one on the left did not.

cities like Glasgow, Scotland, where the incidence of sunshine is very low? Or for babies in the hot California valleys in summer? The answer of course is that vitamin D must be given in the diet, and in recent years this has become routine in most intelligent infant feeding. The first and perhaps still the best and safest way of doing this is by giving cod liver oil or other antirachitic oils.

Effect of Excess Viosterol.—When it was discovered about 1927 that vitamin D is produced by ultraviolet irradiation of ergosterol, an easily procurable sterol, clinicians began at once to give it instead of cod liver oil. This substance, which the American Medical Association named viosterol, was hailed as the great specific for rickets and perhaps other bone disorders. The cases of bowlegs, knock knees, pigeon breasts, distorted spines and pelves, flat feet and bad teeth which are known to follow in the wake of infantile rickets were expected to disappear and a more symmetrical and healthy race to emerge as a result of the use of the new medicine. But, in 1928, the first reports from Vienna[11] dampened our enthusiasm, since it was found that excess viosterol might produce a worse condition than rickets. Experimental animals given large excess doses exhibited loss of appetite, emaciation, diarrhea and hematuria, followed by early death. Hess and Lewis[12] reported a case in an infant with an additional "peculiar mental condition," which was not further described. More than one infant fatality has since been recorded, and it is now clearly recognized that an excess of viosterol may be easily attained and bad effects result. In our studies on dogs and rats,[13] the most striking condition noted when excess viosterol or parathyroid extract was given was the calcification of the kidneys, and this was apparently the usual cause of death. I am told that, in recent years, there has been an unexplained increase in the number of kidney cases in children's clinics. It would be interesting to know how many of these children were given

11. Kreitmaier, H., and Moll, T.: Hypervitaminosis Through Large Doses of Vitamin D, München. med. Wchnschr., 75:637 (April 13) 1928.

12. Hess, A. F., and Lewis, J. M.: Clinical Experience with Irradiated Ergosterol, J. A. M. A., 91:783 (Sept. 15) 1928.

13. Morgan, Agnes F., et al.: Proc. Soc. Biol. Chem., 27:71, 1933.

viosterol during those first years of our experience with this powerful medicament. There is little doubt that the heart, aorta and other large blood vessels may be partly calcified by an excess of vitamin D in this form, as may be the case also when excess sunlight impinges on the skin. The possible danger to middle-aged people of sunbaths, tropical travel and the use of irradiated foods, sun-lamp treatments and viosterol should be considered.

Diet and an Excess of Viosterol.—Shelling[14] and Aub and his co-workers[15] have found, as we have in our laboratory, that both the curative and the toxic effect of vitamin D are enhanced by the calcium and phosphorus content and ratio in the diet fed along with it. A high calcium-high phosphorus diet most exaggerates the toxic effects and a low calcium diet tends to decrease them. Since milk is a high calcium, relatively high phosphorus diet, the danger of an excess of viosterol is greatest for infants and young children, who are usually fed much milk.

On the other hand, the need for vitamin D is greatest when the calcium and phosphorus content of the diet is least. Rapidly growing dogs on a low-calcium diet, even with small amounts of cod liver oil become deformed, dwarfed and crippled and sometimes die. Figure 1 shows two young German shepherd dogs from our laboratory fed a diet adequate in all respects except as to calcium and vitamin D. Dog 188 had a small amount of cod liver oil, but 191 had none. Both these dogs were deformed and Dog 191 became paralyzed and died apparently of the deficiency. Their bones showed severe osteitis fibrosa. A considerable improvement was noted in Dog 188, due to the cod liver oil, but knobby joints and spread toes are evidence that the vitamin cannot entirely overcome a serious deficit in the calcium intake. The roentgen-ray evidence indicated that the bones of the dogs fed cod liver oil were nearly normal, while those of the other dogs were mushroomed, frayed and severely rachitic. The difference in calcification of the costochrondral junction of the ribs of these two animals is plainly evident in Figure 2.

Fig. 6.—Fore ankle of dog, 4 months of age, fed normal diet without vitamin D.

Even when the calcium and phosphorus of the diet are perfectly proportioned, as they were for some of the same litter of dogs, the roentgenograms showed that, in the absence of vitamin D, what would be called severe rickets in a child was

14. Shelling, D. H., and Asher, D. E.: Relation of Ca and P of Diet to Toxicity of Viosterol, Bull. Johns Hopkins Hosp., 50:318 (May) 1932.

15. Albright, F., et al.: Studies of Calcium and Phosphorus Metabolism, J. Clin. Investigation, 7:139 (April) 1929.

present. When the split tibiae of experimental animals are examined in the usual way, the bone produced with no vitamin D is normal but is heavily laced with the spongy bone spicules called trabeculae; the normal vitamin D bone has a clear line of bone growth at the epiphyseal end, and the excess vitamin D bone shows a breaking down and moving away of these trabeculae. Apparently, this solution or washing away into the blood stream of the bony substance is the chief toxic effect of an excess of viosterol, the calcification of the aorta, kidneys and other tissues being the result of this solution.

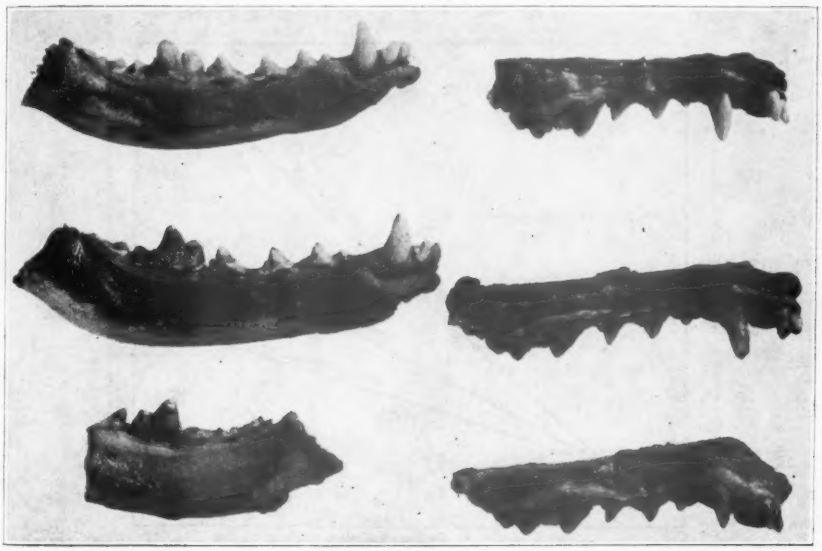

Fig. 7.—Jaws of three setter pups fed adequate purified diet without vitamin D. There is calcification in all cases. The acid-fed dog (41) had rather better enamel than the others.

The Effect of the Acid-Base Value of the Diet.—Another problem connected with bone growth and perhaps also with kidney and blood vessel disease is that of the metabolic reaction or acid-base value of foods. It was noted long ago that various types of diets cause greater or less acidity of the urine, and it was at once surmised that some metabolic advantage might derive from either the decrease or the increase of this acidity. Blatherwick[16] made the first extensive urine observations, but Sherman and Gettler[17] made the chemical analyses of many foods on which the acid-base value in the body might be calculated. The high phosphorus-low calcium foods, such as meat, fish, eggs and cereals, are found to yield an acid residue in the body, while most fruits and vegetables and milk yield

16. Blatherwick, N. R.: Foods in Relation to Composition of Urine, Arch. Int. Med., 14:409, 1914.

17. Sherman, H. C., and Gettler, A. O.: Balance of Acid-Base in Foods, J. Biol. Chem., 11:323, 1912.

a basic residue. Sansum[18] states that there are excellent therapeutic effects from the basic diet in cases of nephritis, and some reports from Edinburgh confirm this. There is no proof, according to Bischoff,[19] that either high blood pressure or kidney changes can be produced or increased by acid ash foods. When an arteriosclerotic patient was given sodium citrate equivalent to 18 pounds of oranges daily for three months, the prebreakfast plasma p_H and total carbon dioxide of the blood remained within normal limits. The claim that an alkaline ash diet or the taking of sodium bicarbonate can decrease susceptibility to colds is as completely unfounded as the similar claim that the taking of acid or alkali by a pregnant woman can influence the sex of the unborn child.

The possibility of an active influence of acid or alkali on bone growth and tooth development must be considered because of the physical increase in solubility of bone constituents in acid mediums. A few years ago, we experimented with several litters of young dogs, particularly two sets of six and seven setter pups of the same parentage. All these dogs were given the same supposedly adequate purified diet; but, to two of each litter, enough sodium carbonate was given to make the urine alkaline; and, to two, ammonium chloride to make the urine acid, and, in two, a neutral reaction was maintained. One of each pair was given cod liver oil. In Figure 3 are shown two of the dogs given ammonium chloride, the larger being the one given cod liver oil. The small size and deformity of the legs of the other are evident. In Figure 4 are

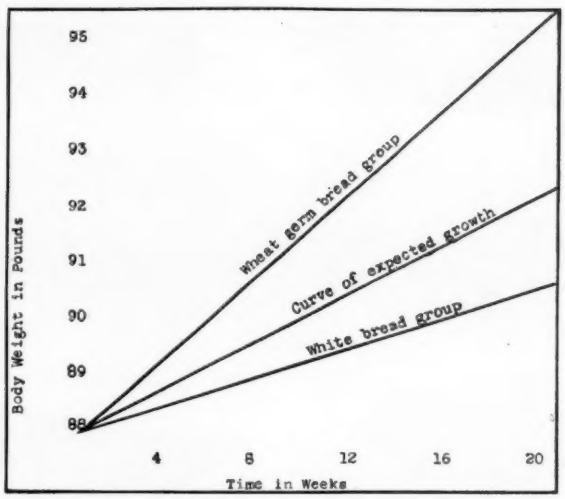

Fig. 8.—Weight-growth curves of 12-year-old children as affected by use of wheat germ.

18. Sansum, W. D.; Blatherwick, N. R., and Smith, F. H.: Use of Basic Diets in Treatment of Nephritis, J.A.M.A., 81:883 (Sept. 15) 1923.

19. Bischoff, F.: Influence of Diet on Renal and Blood Vessel Changes, J. Nutrition, 5:431 (July) 1932.

shown the two dogs of this family in which a neutral reaction was maintained and in Figure 5, the two given sodium bicarbonate. In all cases, the dogs that received vitamin D were bigger and better than the others and the difference was greatest in the pair given ammonium chloride. Apparently, in the absence of vitamin D, the acid diet is most harmful and the neutral diet least harmful. The roentgenograms of the fore ankle of all these dogs getting no vitamin D showed bone lesions similar to those illustrated in Figures 2 and 6.

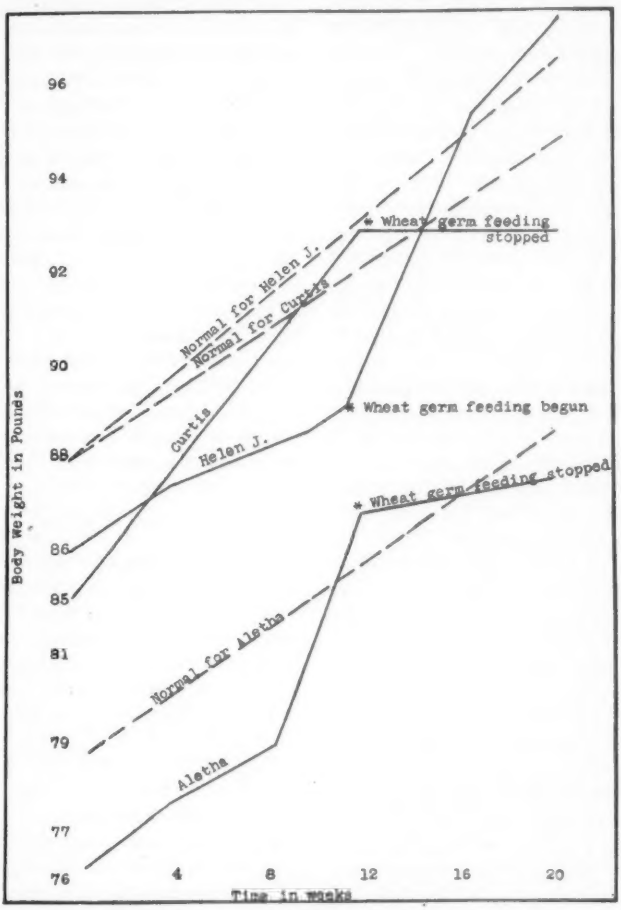

Fig. 9.—Representative weight curve of children, showing effect of wheat-germ feeding.

The animals on sodium bicarbonate were rachitic, perhaps because of their greater rapidity of growth, since they were the largest, the dogs on ammonium

chloride being the smallest and the dogs having a neutral reaction intermediate at nearly all stages in both litters. This is due in part to the retained water in the animals on sodium bicarbonate, for their actual retention of calcium and phosphorus was found to be considerably greater than in the other dogs.

It is interesting to observe the histologic study[20] of sections of the kidneys of all these dogs, which showed a considerably higher incidence of damage in those on the alkaline diet than in the others. Thus, five of seven on an alkaline diet, two of five on a neutral and only one of five on an acid diet suffered obvious kidney damage. Perhaps the dog's kidneys have developed greater resistance to acid than to alkali because of their carnivorous habits, and a similar experiment on other species, for example, man, might not yield the same results.

Similar examination of the mouths of these dogs, seventeen in all, disclosed that eleven had more or less pyorrhea, affecting both jaws and gums. Of these, eight had been on an alkaline diet. Thus, eight of eight on an alkaline diet, two of five on an acid diet and one of four on a neutral showed some pyorrhea. Vitamin C deficiency could not enter into these findings since dogs have been shown not to be subject to scurvy.

Destruction of the enamel of the teeth was seen in nearly all the dogs that had no vitamin D, but no selective damage could be detected in the acid-fed group as has been claimed by certain dental workers. Figure 7 shows the dissected jaws of three of the dogs, fed adequate diet, but without vitamin D. The dogs fed cod liver oil had normal teeth.

It will be seen, then, that as far as growth and development of bones are concerned, a diet otherwise adequate and acid in reaction is not injurious provided vitamin D is given abundantly. If vitamin D in cod liver oil or some other fish liver oil, in viosterol or in irradiated foods is not given in sufficient amount, the acid diet is more injurious to young animals than is either the alkaline or the neutral diet. Even the latter diets are not able completely to prevent bony abnormalities without vitamin D; but the acid diet usually meant in discussions of this kind is not adequate in all other respects, but has all the inequalities and unbalance of a predominantly meat, egg and cereal diet. These foods have an important place in a mixed diet, but are lacking in calcium and vitamin D and high in phosphorus if not balanced by other foods; that is, vegetables, fruit and milk. A meat and cereal diet is acid, low in calcium, high in phosphorus and low in vitamin D, like the diet on which the young dogs shown in Figure 1 were fed.

THE ANEMIAS

The occurrence of nutritional anemia is now recognized as widespread, especially among infants, young children and pregnant or lactating women. The simplest form is that which results from a long continued low-iron diet, such as milk. Formerly, nearly all babies showed some anemia or low content of blood hemoglobin by the time they were 1 year of age. Any child which is fed too much milk and too little of the iron-carrying foods, such as green vegetables, liver, egg yolk and red or dark meat, is likely to be pale and weak, and subject to respiratory infections. The dietetic origin of this trouble was clearly shown, largely by the Wisconsin group under Hart and Elvehjem,[21] and by Whipple and Robscheit-

20. Becks, Hermann, and Weber, Moritz: Influence of Diet on Bone, J.A.D.A., 18:197 (Feb.) 1931.

21. Hart, E. B., et al.: J. Biol. Chem., 77: 797 (May) 1928.

Robbins[22] first, working in the Hooper Institute for Medical Research in San Francisco. Out of the good results obtained by the latter when liver was fed to anemic dogs arose the dramatic discovery of the means of alleviating or curing pernicious anemia. Drs. Minot and Murphy, Boston clinicians, thought that it might be worth while to feed liver to their patients having pernicious anemia, even though this disease was recognized as quite distinct from, and far more serious than, the experimental anemias produced by Whipple and Robbins. By a remarkable coincidence, liver was found to be effective in pernicious anemia also, but probably for an entirely different reason from that accounting for its value in nutritional or secondary anemia. This shot in the dark by the resourceful and ever-hopeful clinicians resulted in one of the most remarkable of modern advances in the treatment of disease. The seat of the trouble in pernicious anemia, as possibly in sprue, pellagra and several other related conditions, appears to be a defect in the digestive tract, probably in the stomach. A diet adequate in all respects may become inadequate because of the failure of the stomach to make some necessary food factor available. One may glimpse a long and brilliant vista of future studies in this field.

POSSIBLE IMPORTANCE OF VITAMIN B IN MAINTAINING THE HEALTH OF THE DIGESTIVE TRACT AND THE NERVES

When the water-soluble vitamins were first clearly shown to be necessary, the whole group, other than the antiscorbutic, that is vitamin C, were lumped together as vitamin B. It was not until 1928 that it became generally recognized that at least two distinct vitamins were present in B. These are called in the United States B, the antineuritic substance, and G, the antipellagric.

With this discovery, a new evaluation of the various articles of diet had to be made, in order to determine whether we are justified in the comfortable assurance formerly felt that all natural foods are sufficiently endowed with these vitamins. It begins to look now as though this is false and that although nearly all natural foods will usually support some growth in young animals if fed as a B complex, this may not be the case if they are tested separately for vitamin B and vitamin G.

THE SYMPTOMS OF VITAMIN B DEFICIENCY

McCarrison[23] showed, as early as 1919, that severe gastrointestinal symptoms were the first results of a lack of vitamin B and that loss of appetite accompanied or preceded these symptoms. Cowgill,[24] at Yale, has demonstrated the same thing with dogs, and the experience of every nutrition laboratory bears this out. Polyneuritic pigeons disgorge their food even though they are daily hand fed. The involvement of the nervous system is seen in later stages with head jerking, running, screaming fits and irregular gait in young rats and retraction of the head and cartwheel convulsions in pigeons. All of these symptoms have their counterpart in a mild way among human beings, especially children. The most frequently met complaint by mothers of young children nowadays is that the children won't eat. The better educated and more con-

22. Whipple, G. H.; Hooper, C. W., and Robscheit-Robbins, F. S.: Blood Regeneration After Anemias, Am. J. Physiol., 53:236 (Sept.) 1920. Whipple, G. H., and Robscheit-Robbins, F. S.: Am. J. Physiol., 72:395 (May) 1925.

23. McCarrison, R.: Studies in Deficiency Disease, London: Oxford University Press, 1921.

24. Cowgill, G. R., et al.: Studies in Physiology of Vitamins, Am. J. Physiol., 73:106 (June) 1925; 77:389 (July) 1926; 96:372 (Feb.) 1931.

scientious the mother, the more persistent is this complaint. These same children are usually nervous, irritable and underweight. Often enough, they suffer from constipation, diarrhea and occasional vomiting. Almost the same description may be applied to a large part of the adult population. It is at least possible that a low vitamin B intake may be the cause.

If we reexamine our best American diet for its vitamin B, as apart from its B and G content, we see that the most commonly used foods are strikingly deficient in vitamin B, but fairly well endowed with vitamin G. Thus, muscle meat is a good source of G, but low in B, and the same is true of nearly all fruits and vegetables and of milk and eggs. The highly milled cereals generally used in America have lost most of their germ and bran, in which the vitamin B is largely found. The increased use of canned vegetables and fruits has still further decreased the vitamin B obtainable from these foods, since the high temperature of processing destroys it in large part. We have found, for instance, that canned spinach and peas lose at least three fourths of their B value when canned by the best commercial processes.

The well-advised patients of the scientific medical man who use milk, fruits and vegetables in large amount are likely to have a vitamin-B-deficient diet, although its adequacy in other respects may be much improved over that consumed by our forefathers. In a number of instances, excellent results have followed the addition of whole grain cereals, wheat germ, rice polish, yeast or one of the concentrates made from these substances. Hoobler[25] and Dennett[26] have advocated the routine addition of vitamin B in some form to infants' formulas, to supplement the low-B content of milk. The use of these B supplements in neuritis, rheumatism and arthritis, the unpleasant NRA of middle life, has had encouraging results in many cases. Also, constipation, colitis and some types of gastric indigestion often yield to this treatment.[27]

A few years ago, we tried out our theory as to the possible rôle of vitamin B in the growth of children by an experiment at Garfield Junior High School in Berkeley.[28] Two groups of underweight children were weighed and measured carefully and one group were induced to include some wheat germ rolls in their lunch every school day for two periods of eight and seven weeks. The others had the usual white rolls, and no other change or restriction was placed on their free choice at meals. At the end of these periods, the measurements were repeated and the groups now reversed; that is, those who had had wheat germ rolls now took the white rolls, and vice versa. At the end of twelve weeks, the measurements were made again. In both periods, the increase in weight of the children eating the wheat germ was nearly three times as great as that of the other group. The excess increase in height, while not so great, was also obviously in favor of the wheat germ periods. In Figure 8 are shown the expected curve of growth for children of this age and the curves for the two groups. The white bread groups have lower than the normal rate, since they were chosen because they were under weight. The wheat germ groups

25. Hoobler, B. R.: Symptomatology of Vitamin B Deficiency in Infants, J.A.M.A., 91:307 (Aug. 4) 1928; 96:675 (Feb. 28) 1931.

26. Dennett, R. H.: Routine Use of Vitamin B Factor in Infant Feeding, J.A.M.A., 92:769 (March 21) 1929.

27. Montague, J. F.: Vitamin B Deficiency and Constipation, M. J. & Rec., 137:314 (April 19) 1933. Fletcher, A. A., and Graham, Duncan: Am. J. M. Sc., 179:91 (Jan.) 1930.

28. Morgan, Agnes F., and Barry, M. M.: Underweight Children: Increased Growth Secured Through Use of Wheat Germ., Am. J. Dis. Child., 39:935 (May) 1930.

show accelerated growth. Figure 9 contains a few weight curves of individual children, showing the rapid increases brought about by the feeding of the B-containing wheat germ and the interruption when it was stopped. We use wheat germ because it is a cheap natural food with nobody's trademark on it and because we hoped that this mill product might be made generally available at a low price. So far, this hope has not been realized.

I have spoken of only three or four aspects of diet as related to health. I might have chosen any one of a dozen other equally important and intriguing phases of the same subject. In closing, I suggest that you think of diet not as a vague affair which may be considered as of no importance as long as hunger is satisfied nor yet as a magical wand with which all physical ills may be conquered, but instead as a field for research in which limitations and possibilities are rapidly being uncovered, but which is still exploited by plausible charlatans and ignoramuses. The present attempt in Congress at improvement and tightening of federal control of food and drugs is meeting determined opposition by those who will profit by continuing the gullibility of the public. There are plainly set limits to what both foods and drugs can do, and it is the right of the purchaser to have these set forth along with whatever claims are made on the label of the package or by other medium of advertising. Already some of the most effective teeth have been drawn from the Tugwell-Copeland bill, and it seems doubtful whether it will survive even in its emasculated form. Aggressive defense by consumers is all that can save it from the aggressive attack by interested manufacturers and advertisers. Enough advantage can be proved to reside in sane scientific choice of food to make it worth while to fight for the dissemination of this information to all the people.

CONSTRUCTIVE TREATMENT OF DISEASED PARADENTAL TISSUES*

By T. SYDNEY SMITH, D.D.S., F.A.C.D., San Francisco, Calif.

SCIENTIFIC investigation has proved that paradental septic foci constitute a serious menace to the general health, and that they should be eradicated even if it necessitates the removal of the teeth. At the same time, there is a wide variance in the theories advanced by investigators regarding the involved dental structures, the possibility of retaining these structures in a state of health, and the methods employed in the treatment of paradental septic lesions. These methods of treatment range all the way from the surgical removal of the separated portions of the gums and a considerable quantity of bone, to the most minute and gentle subgingival operation, to aid the separated tissues to form an organic reunion with the cementum. The object of this paper is to

*Read before the Section on Periodontia at the Seventy-Sixth Annual Session of the American Dental Association, St. Paul, Minn., Aug. 9, 1934.

present the possibility and method of securing this organic reunion of the tissues.

The revival of the old method of trimming off the gums and the adoption of destructive prophylactic methods can be traced in a large measure to the widely accepted belief that the destruction of the investing tissues and the loss of the permanent teeth is a normal, a physiologic process. Quotations will show the exact character of this discouraging theoretical influence.

In 1905, Talbot[1] wrote:

Man has two sets of teeth; the first set

Fig. 1.—Cemento-enamel junction.

is lost, and a second set takes its place. These in turn will be lost if he live long enough. As soon as the alveolar process has obtained its growth (in degenerates it commences much earlier) interstitial gingivitis sets up, and there is a gradual absorption of the bone from the start. Nature is trying to shed the second set of teeth.

In 1911, Hopewell-Smith[2] said:

The teeth of dogs, cats, monkeys, and other animals, either in a domesticated environment or in *natura fera,* become loose as time passes by, as a direct consequence of the absorption of their sockets —a physiologic process. Man becomes more and more inclined to be edentulous as he advances in life, a part of the decadence of his vital powers.

Gottlieb[3] also supports the theory of uncontrollable destruction. He calls the normal gingival sulcus a pocket, and says[4]: "The bottom of the pocket never stays longer at the amelocemental junction than at any other point on the tooth surface." He calls this the apical migration of the epithelial attachment, and writes[5]: "For the present, we cannot exert any certain influence on the rate of

Fig. 2.—Plaster model; showing septal points of gingivae well preserved when patient was over 92 years of age.

the apical migration of the epithelial attachment." He also claims that the loss of the alveolar crest is merely part of a physiologic process. This statement reads[6]: "The atrophy of the alveolar crest concurrently with the displacement of the bottom of the pocket must be regarded as an integral part of the physiologically continual eruption of the tooth." He includes the entire root when he speaks of the eruption of the tooth, for

1. Talbot, E. S.: D. Cosmos, 47:1311 (Nov.) 1905.
2. Hopewell-Smith, Arthur: D. Cosmos, 53:990 (Sept.) 1911.
3. Gottlieb, Bernard: Tissue Changes in Pyorrhea, J.A.D.A., 14:2178-2207 (Dec.) 1927.
4. Footnote 3, p. 2183.
5. Footnote 3, p. 2205.
6. Footnote 3, p. 2188.

he writes[7]: "Biologically speaking, we know only of an eruption of the tooth as a whole, independent of any separation into crown and root."

Hopewell-Smith goes still further, discouraging all attempts to secure an organic reunion of the separated tissues to the cementum. He claims there can be no regeneration or recalcification of the involved bone. His statement reads[8]:

The hopelessness of retaining the teeth and of building up bone which has been lost by absorption or the recalcification of decalcified foundations must be apparent.

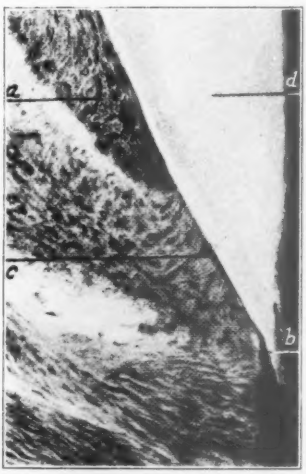

Fig. 3.—Human cementum overlapping cervical edge of enamel. *A*, mouth epithelium. *B*, cementum that overlapped enamel. *C*, slight trace of enamel epithelium. *D*, space formerly occupied by enamel. (Gottlieb.)

The treatment, at best, can only be palliative, and, unfortunately, only directed to the prevention of further destruction, and not the rehabilitation or reconstruction of parts absolutely forever destroyed, and not admitting of the adoption of certain plastic measures which obtain, at times, in connection with other bones of the body.

Black states[9]: "Suppurative detachments of the peridental membrane are permanent detachments."

These and similar deductions were usually the result of histologic studies of animal dental tissues, and human dental tissues that had received no special care. Orban and Mueller, who support the assumption of uncontrollable destruction, write[10]: ". . . our material was obtained largely from human beings who had exercised little oral hygiene."

Neglected and diseased gingival tis-

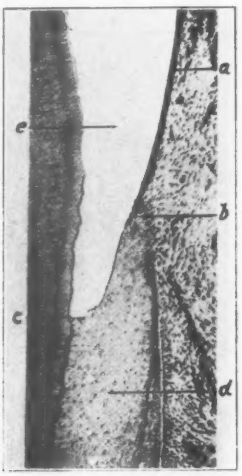

Fig. 4.—Cementum of pig's tooth overlapping cervical edge of enamel. The form of these structures differs considerably from that of the human structures. The pig's cementum also contains many lacunae. *A*, enamel epithelium. *B*, thick edge of cementum overlapping enamel. *C*, thick cervical edge of enamel. *D*, cementum containing many lacunae. *E*, space formerly occupied by enamel. (Gottlieb.)

7. Footnote 3, p. 2185.
8. Footnote 2, p. 991.
9. Black, G. V.: Special Dental Pathology, p. 185.
10. Orban, Balint, and Mueller, Emil: Development of Bifurcation of Multirooted Teeth, J.A.D.A., 16:1223 (July) 1929.

sues should be examined histologically to determine the exact character and amount of destruction that has occurred, but it is much more important to study the protective measures and reconstructive properties of the tissues. It is misleading to call neglected gingival tissues normal; their condition is comparable to unsanitary conditions and consequent loss of life among backward races, where scientific control is not known. When histologic studies of neglected and diseased gingival tissues are unaided by proper clinical work, they lead too frequently to misinterpretation, the investigation being incomplete. Instead of the investing tissues of the teeth being transient, with Nature bent on destroying them long before other tissues of the body, they are found to be resistant to injury and infection and respond rapidly to any assistance that is given. It will be shown

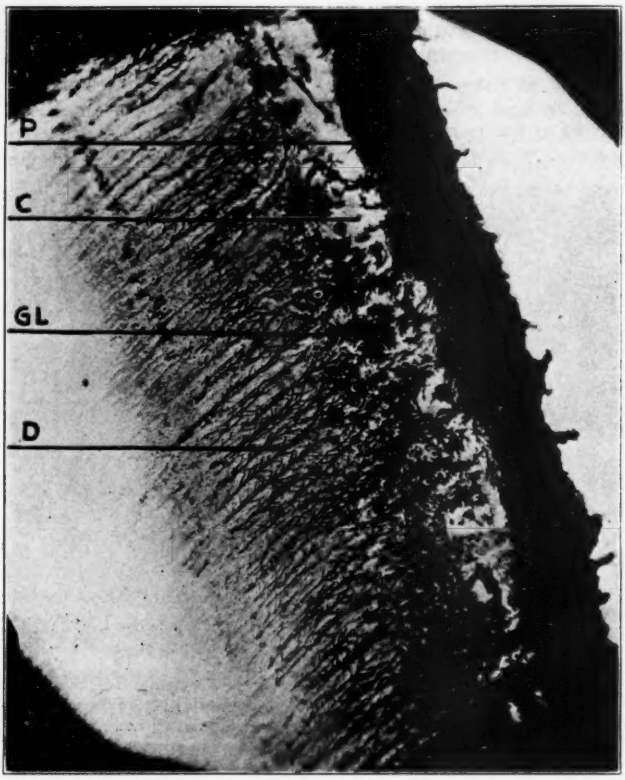

Fig. 5.—Longitudinal section of root extracted when child was 9 years old. The first lamella was forming in disconnected segments over the granular layer of the dentin. *P,* pericementum. *C,* cementum. *GL,* granular layer. *D,* dentin. (Photomicrograph lent by J. S. Engs, Oakland, Calif.)

later that an organic reunion of the separated investing tissues with the cementum and extensive regeneration of bone, as well as recalcification of the decalcified bone matrix, have been accomplished.

No special importance can be attached to these scientific achievements, unless the functions of the investing structures of the teeth and the need for certain definite anatomic forms of these structures are clearly understood. The teeth, which are highly specialized bones, protrude through the soft tissues in an environment where they become coated with débris and harbor an abundant flora of bacteria. In addition to this, the margins of these soft tissues receive much pressure and friction from food. When we bite into food, it must of necessity pass upward over the upper teeth and gums, and, at the same time, downward over the lower. The soft tissues conse-

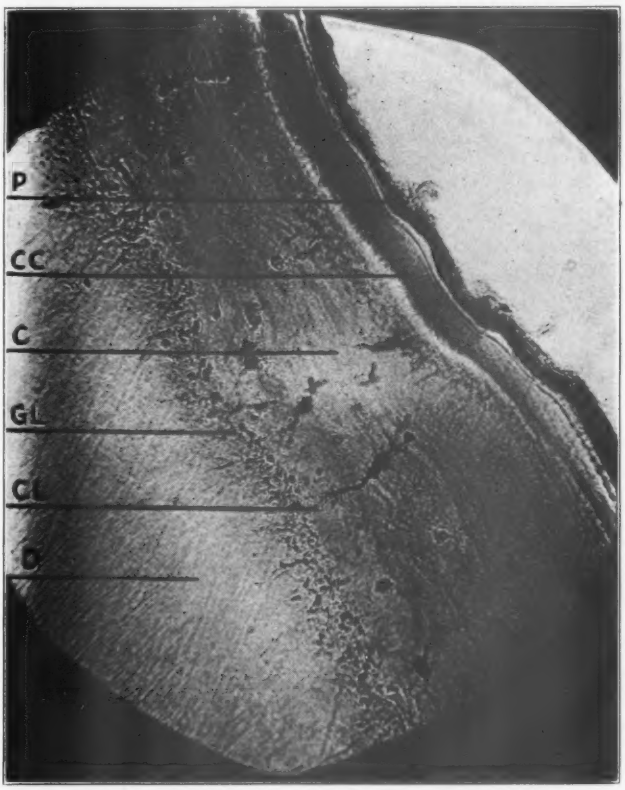

Fig. 6.—Longitudinal section of root extracted when patient was 65 years of age. There was no barrier to the passage of nutriment at the dentino-cemental junction. *P,* pericemental fibers. *CC,* outer compact layers of cementum. *C,* cementum. *GL,* granular layer. *CL,* canaliculi of cemental lacuna. *D,* dentin.

quently develop thin, tough free margins, which act as buffers to protect their attachment to the teeth. These free margins are necessary for protection, but they create a sulcus around each tooth, which, if deep, retains débris and provides a favorable place for the development of bacteria. It is therefore essential that the epithelial covering at the bottom of the sulci be attached to the teeth nearer to their incisal edges on the proximal sides than on their labial and lingual, in order to provide sloping, self-cleansing floors for the sulci. Great care should be taken not to sever the tissues at this central high point. Figure 1 shows this line of attachment. A more evident provision is made for the cleansing of the sulci and the protection of the deeper structures, by giving the free margins of the gingivae their greatest length on the proximal sides of the teeth. These triangular septal points of the gingivae, as shown in Figure 2, form a series of inclined planes. They not only fill the interproximal spaces of the teeth and prevent the entrance of food into these spaces from the labial and lingual sides, but they also serve to slide the food over the deeper structures and permit just

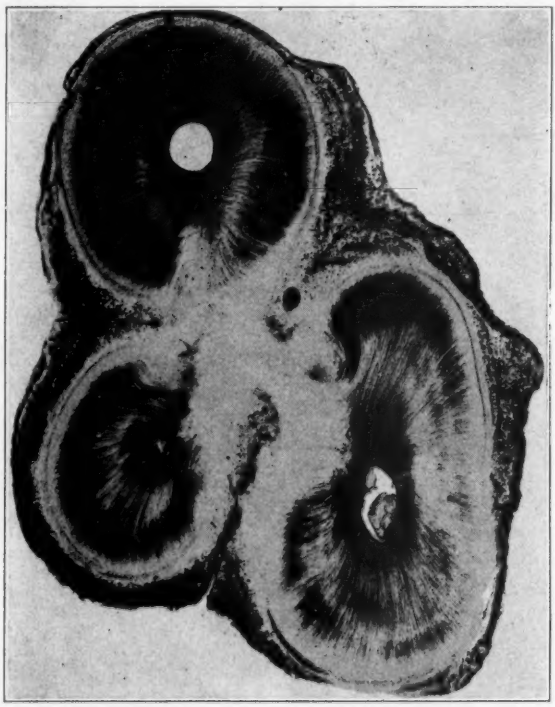

Fig. 7.—Three deep longitudinal grooves filled with cementum; showing variations in thickness of cementum.

enough of it to pass through the sulci to cleanse them. It is one of the major mistakes of modern dentistry to force the bristles of a toothbrush into or through these interproximal spaces, unless much of the investing tissues already have been destroyed by infection or radical operation. The proximal sides of the teeth, including the contact points, should be cleaned in a much more thorough and gentle manner. It requires a friction which comes from the direction of the crowns of the teeth to stimulate the circulation in the gingivae. When the free margins of the gingivae are swollen or their septal points are shortened or removed, they form an obstruction to the passage of food and are bruised and injured by it. The patient whose gums are shown in Figure 2 was 92 years of age and had worn an ill-fitting partial denture, but she still had septal points of the

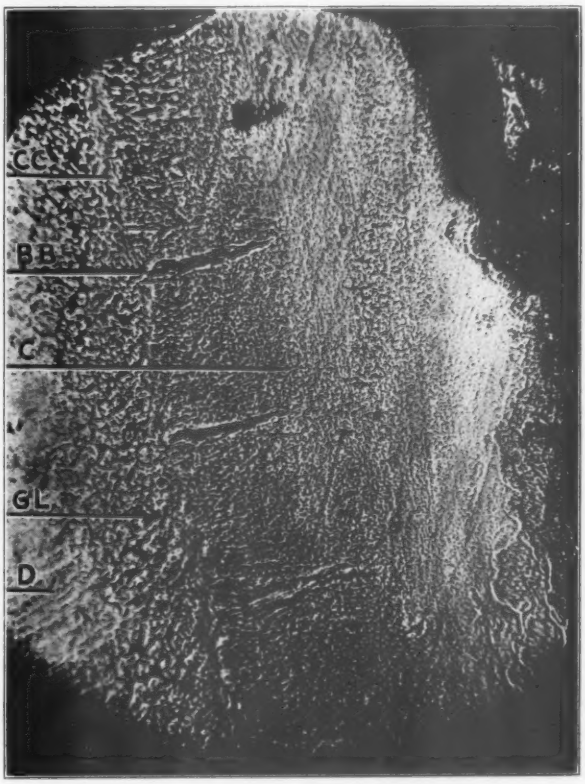

Fig. 8.—Longitudinal section of tooth which had relatively compact first-formed lamella of cementum. *CC*, compact first lamella of cementum. *BF*, bundle of fibers. *C*, cementum. *GL*, granular layer. *D*, dentin.

gingivae that could perform their function. These necessary structures should never be deliberately destroyed.

The functions of the investing soft tissues of the teeth and the need for retaining these tissues can be understood more clearly by tracing their development from the beginning of the eruption of the permanent teeth. When the incisal edge of a tooth first becomes visible, the remaining covered portion of the enamel is still organically united with the overlying enamel epithelium. An instrument cannot be passed to the cemento-enamel junction without destroying this union of the tissues. As soon as the edge of the tooth severs the overlying soft tissues in the process of erupting, the mouth epithelium quickly unites with the enamel epithelium in order to cover and protect the underlying connective tissues. As the eruption of the tooth progresses, a gradual degeneration of the margin of the enamel epithelium sets in. At the same time, the thin, free margin of the soft tissues slowly atrophies to prevent the development of too deep a sulcus. This atrophy is purely physiologic, and must not be confused with recession of the gums beyond the cemento-enamel junction. The degeneration of the enamel epithelium usually progresses very slowly on the cervical third of the enamel. The tissues frequently remain attached to this portion of the anatomic crown for a number of years after the tooth has reached the occlusal plane.

The importance of this delayed eruption of the cervical third of the anatomic crown cannot be overestimated. It permits the cervical portion of the cementum

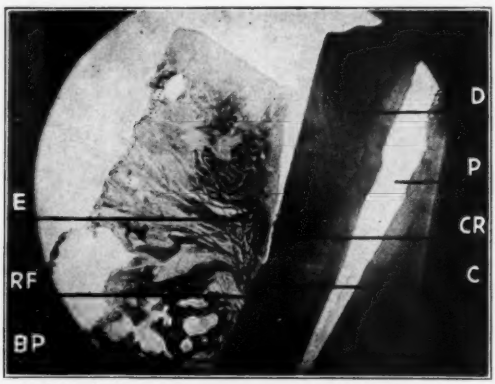

Fig. 9.—Section showing results secured in experimental work. Originally the pocket extended to the bottom of the section. During the treatment, the cementum was surgically prepared for reattachment of the tissues at the bottom of the pocket, but removed from the cervical portion of the dentin. *D,* dentin. *P,* pulp canal. *CR,* cementum removed. *C,* cementum. *E,* epithelium. *RF,* reattached fibers. *BP,* bottom of original pocket. The histologic evidence of an organic reunion of the tissues at the bottom of the pocket where the cementum was prepared correctly, and the failure of the tissues to unite with the denuded dentin, as seen in Figures 9 and 10, was secured by Dr. Willard C. Fleming, Oakland, Calif., during an investigation of the various methods employed in the treatment of paradental septic lesions, conducted by the Dental Department of the University of California.

to develop the required thickness and to overlap the edge of the enamel, as shown in Figures 3 and 4. Early separation of the tissues from the cervical third of the anatomic crown forces the attachment of the sulcate epithelium below the cemento-enamel junction before the cementum at that point is properly developed. It must therefore be obvious that the teeth should be cleaned in a very gentle manner in order to retain the attachment of the tissues to the teeth. It is essential that the gingival tissues not be poked with sticks or irritated with stiff, irregular-shaped brushes.

The gingival tissues occasionally become hypertrophied during this early developing stage. These hypertrophied tissues should not be removed surgically. The surgical removal creates cicatricial tissues and prevents the full development of the septal points. Usually, all that is required is thorough, careful polishing of the underlying tooth surface at repeated intervals, and very gentle cleaning at home.

In describing the progressive stages of apical migration of the epithelium, Gottlieb throws considerable light on this important problem. He furnishes conclusive evidence that a downward growth of the epithelium is a protective measure, not a destructive force. Calling the normal adult gingival sulcus "a pocket," he states[11]: "In ideal cases, the pocket epithelium is hornified down to the bottom. The opposite tooth surface is covered with horny cuticle. The depth of the pocket is very small. Thus, we find, at the weakest point of our denture, an ideal protection against injury." Then he admits[12]: "As long as connective tis-

Fig. 10.—Portion of Figure 9, higher magnification. *D*, dentin. *CR*, cementum removed. *C*, cementum. *RF*, reattached fibers.

11. Footnote 3, p. 2197.
12. Footnote 3, p. 2201.

sue fibers are anchored in the surface of the cementum below the epithelial attachment, a downward growth of the latter is obviously out of the question." He makes it clear that it is a separation of these connective tissue fibers from the cementum which permits the epithelium to grow downward and that this new growth of epithelium is a protective measure—an effort to cover the exposed connective tissues and prevent any further separation at the bottom of the lesion. On this point, he writes[13]: "I thus picture to myself the effect of the inflammation on the proliferation of the epithelium: in cases in which the inflammation has killed either the connective tissue fibers or the cementum surface or both, the connection will be dissolved and the epithelium will proliferate downward in accordance with its inevitable laws until it meets an organic connection between the connective tissue fibers and the cementum surface." He also states[14]: "We can readily imagine that after the detachment of these fibers from the cementum, the epithelium (as in many other analogous processes) proliferates downward to cover the exposed connective tissue."

Fig. 11.—Effect of deep cutting into dentin.

The normal shallow adult gingival sulcus, which provides such ideal protection against injury at the weakest point of our denture, should not be called "the gingival crevice." The Century dictionary states that a crevice is a crack, a cleft, a fissure, a rent, words that indicate destruction. If the term crevice is used at all, it should be applied only when there is a detachment of the connective tissue fibers from the cementum, before the rent is deep enough to be properly called a pocket. Even then, the use of the term may be confusing.

Reattachment of the separated connective tissues by the cementum and the obliteration of the paradental septic pocket can be accomplished by the subgingival operation, but the location of the wound and the character of the involved structures demand rapid healing to prevent recoating of the root surface with débris. To accomplish this, the biologic requirement of each of the tissues must be understood and strictly adhered to.

Fig 12.—Loss of bone before subgingival operation.

The blood plays an essential part in the success of subgingival surgery. It is cleansing, reconstructive and bactericidal in its local action.

13. Footnote 3, pp. 2202-2203.

14. Footnote 3, p. 2201.

When a paradental pocket is given correct surgical treatment, there is very little hemorrhage, but this small amount aids in cleansing the wound, as it coagulates and incorporates the loosened particles of calculus in the meshes of its fibrin. This permits the instruments to remove them from the wound much more thoroughly than could be accomplished by washing. By this method of cleansing the soft tissues are left in close contact with the root, free from damage by water or other cleansing agents and ready for rapid healing.

The reconstructive property of the blood is of inestimable value; it makes rapid healing possible through coagulation. When the walls of the pocket are prepared surgically and all particles of calculus are removed from the wound by the instruments, a blood clot should be allowed to form. The last act should be to start a slight hemorrhage in the bottom of the wound and allow it to coagulate without interference; any further instrumentation would defibrinate it. The blood-clot thus formed seals the wound and becomes organized into connective tissue.

Fig. 13.—Tooth shown in Figure 12, five years after subgingival treatment.

The bactericidal action of the blood is equally helpful. Paradental septic pockets are chronic infections. Therefore the blood becomes fortified with antibodies which quickly destroy the remnant of bacteria in the wound, when the tissues are aided by surgical procedure. These anti-bodies have a definite specificity in their bactericidal action. Antiseptic and germicidal agents should not be used.

On the soft tissue side of the pocket, a downward growth of the sulcate epithelium, to cover and protect any detached connective tissue fibers, frequently increases the difficulty in reattaching these fibers to the cementum. Usually, this new epithelial covering is so thin and poorly organized that the introduction of a smooth exploring instrument into the pocket will start a slight hemorrhage. These cases require no special effort to remove the epithelium, as the surgical instruments, no matter how carefully they are handled, leave the connective tissues sufficiently uncovered to permit reattachment by the cementum. When the tissues remain detached for a long time, the epithelial covering may become so thick and so well organized that a surgical instrument can be passed to the bottom of the pocket without causing a hemorrhage. In these cases, the epithelium must receive special attention. It should be removed either surgically or chemically. The surgical method usually leaves too large a wound. The soft tissues must be left in close contact with the

Fig. 14.—Extensive loss of bone.

root, and free from laceration or bruising. The wound should be small, requiring but little repair. If the use of a chemical agent is resorted to for the removal of epithelium, operation should not be undertaken until the inflammation has subsided and the tissues are again in close contact with the root. The chemical removal of epithelium is still in the experimental stage. An agent that will destroy and remove the epithelium may also destroy the cementum, and prevent reunion of the tissues.

The cementum plays an essential part in the preservation of the investing tissues of the teeth, and in the success or failure of subgingival surgery. It is important,

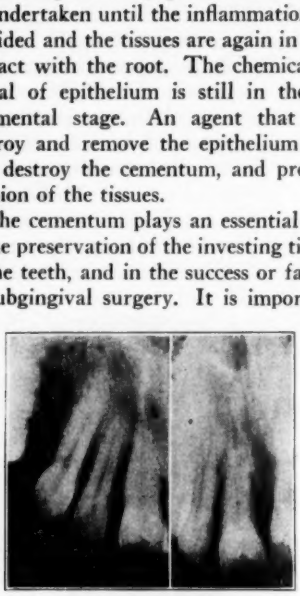

Fig. 15.—Case shown in Figure 14, nine years after subgingival surgical treatment.

then, that its function, its development and form and the source of its nutriment be clearly understood. Its function is to attach to the tooth the surrounding connective-tissue fibers, and, in adult life, the inner margin of the sulcate epithelium. When its development is uninterrupted, it overlaps and protects the cervical margin of the enamel.

Connective tissue fibers of the pericementum become attached to the root by cementum forming around their ends, and by the ends of these fibers being calcified. If, for any reason, these fibers become detached, they can be reattached by the development of a new layer of cementum. The ever-changing relation of the teeth and the various directions from which they receive stress require the formation of layer after layer of new cementum to attach and reattach the fibers and adjust them to new directions of strain. Figures 5 and 6 show the marked change that takes place in cementum when new layers are added to the surface. These new layers of cementum not only increase the size of the root but also frequently make its surface more nearly level by filling longitudinal grooves. Figure 7 demonstrates this leveling process. Three deep grooves had been filled by the cementum. When resorption removes a portion of the cementum and burrows deep into the dentin, the surrounding bone may extend into the space, but usually it is the cementum that fills and repairs the lesion. When a portion of a root is left in position during an extraction, the cementum may cover the fractured end and extend down into the pulp canal, as shown in a former paper.[15] The cementum is always thinner on the cervical third of the root than on the apical portion, but it may vary greatly in thickness at different points around the circumference of the root, as shown in Figure 7.

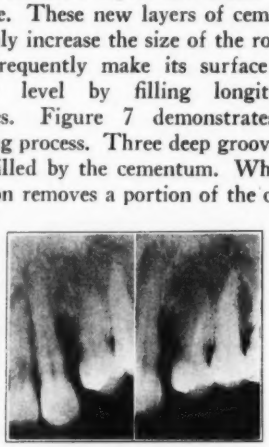

Fig. 16.—Loss of portion of cortical plate and underlying bone.

15. Smith, T. S.: Tr. Sixth Internat. D. Cong., p. 211.

The source of the nutritive supply of cementum has long been a controversial question. Some investigators claim that it receives all of its nutriment from the pericementum and dies and becomes pus-soaked sequestrum when separated from this source. Others believe that it receives nutriment from the pulp as well as from the pericementum, and does not necessarily die when separated from the pericementum as long as the pulp remains vital. Figures 5, 6 and 8 throw much light on this important question.

Figure 5 shows the photomicrograph of a longitudinal section of a developing root, extracted when the child was 9 years of age. The first lamella of cementum, which is believed by many histologists to form a dense, impenetrable barrier to the passage of nutriment, was forming in disconnected segments over the granular layer of the dentin. There was nothing at that stage of development to prevent the passage of nutriment between the pulp and the pericementum. It can be seen that interference with the development of the cervical portion of the cementum would damage the tooth permanently.

Fig. 17.—Case shown in Figure 16, after subgingival surgical treatment. The cortical plate was restored.

Figure 6 shows a longitudinal section of a cuspid root extracted when a patient was 65 years of age. The cementum in this case had increased considerably in thickness, but there was still nothing to prevent nutriment from the pulp passing beyond the granular layer of the dentin into the cementum. Some of the canaliculi of the cemental lacunae were directly connected with the granular layer. The section, being cut in a single plane, does not show the full extent of these channels, as they are very irregular. Many of them appear as disconnected dots, when in reality they are continuous passages in the specimen from which the section was cut. Several of the outer, last-formed lamella were much more compact than the rest of the cementum, but all will agree that nutriment from the pericementum passed into and through these lamellae. The cementum in this case undoubtedly received its nutriment from the pulp as well as the pericementum.

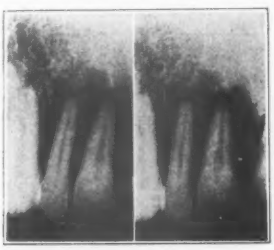

Fig. 18.—Extreme loss of bone before subgingival surgical treatment in 1925. The apex of the root was badly resorbed, but the pulp was still vital.

Figure 8 shows a section of a root in which the first formed lamella was more compact than the rest of the cementum, but with the magnification used in this case, it was found to be cancellous. It was only relatively more compact. The presence of canaliculi of the cemental lacunae, or large bundles of fibers, is not necessary for the transmission of nutriment, which passes into and through the cementum by osmosis.

Magnified sections of cementum make it appear very thick, when in reality it is so thin on the cervical third of the root, especially in early life, that great care must be exercised not to damage or remove it. Figures 9 and 10 demonstrate this danger. These photomicrographs show that a large section of cementum had been removed from the root by instruments while attempts were being made to reunite the tissues by subgingival operation. It is not uncommon to find not only that has the cementum been removed but also that the instruments have cut away much of the dentin, as shown in Figure 11. Débris and calculus must be thoroughly removed from the cementum, but great care should be taken not to cut through the last-formed compact lamellae and expose the lacunae in the central portion. A tooth that has been treated unsuccessfully is usually difficult to cure. In many of these cases, the root is damaged beyond repair.

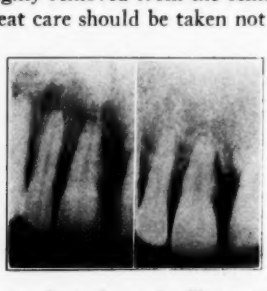

Fig. 19.—Case shown in Figure 18, three years after subgingival surgical treatment. The pulp was vital, and the investing tissues were reunited to the root.

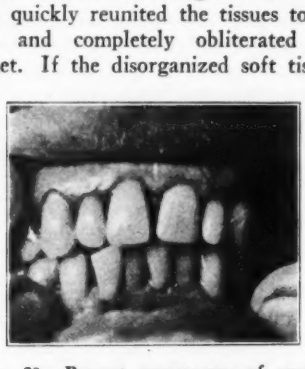

Fig. 20.—Present appearance of reunited gums in case shown in Figures 18-19. There was no recession of the gums from the treatment.

Clinical cases which demonstrate various types of bone regeneration have been selected for this paper. One of the most necessary changes is the restoration of the cortical plate.

Figure 12 shows a roentgen-ray film of a lower left lateral incisor before it was operated on, in 1925. At that time, the destruction of the bone had progressed to within 2 mm. of the apex on the distal side of the root, and the bone surrounding the pocket had developed a highly calcified layer on its surface, which resembled the cortical layer beneath healthy tissue. As the pocket was on the lower arch, where drainage of the pus was difficult, the calcified surface layer was probably a defensive measure, an effort to wall off and protect the deeper structure. One gentle operation which extended to the bottom of the pocket, but did not remove the disorganized soft tissues, quickly reunited the tissues to the root and completely obliterated the pocket. If the disorganized soft tissues had been removed from the pocket, the necessary rapid healing would have been impossible. Figure 13 shows the condition of the tooth in 1930; 7 mm. of bone, with an extremely thick cortical layer, having filled the space. The overlying gingival tissues were in an excellent state of health.

Kronfeld says[16]: ". . . without connective tissue attachment, bone regeneration is impossible."

A greater amount of bone regeneration,

16. Kronfeld, Rudolf: J. Periodontology, 4:12 (Jan.) 1933.

but which lacked a good cortical layer, resulted from a single subgingival operation, in 1919. Figure 14 shows the condition of the bone before the operation. The destruction extended almost to the foramen on the distal side of the upper right central incisor, and to within 2 mm. of the apex on the mesial side of the lateral incisor. The instrument could be passed freely from one root to the other. There was a considerable amount of hard calculus on both roots, which showed that the pocket had existed for a long time. The tissues healed rapidly and required no treatment beyond prophylactic care. Figure 15, a roentgenogram made in 1928, shows that 9 mm. of bone had formed between the central and lateral incisor roots, and the healing process had drawn them closer together. The bone between the lateral incisor and the cuspid was also greatly improved.

A case treated in 1925 shows the possibility of securing a good cortical layer on the regenerated bone and an excellent reunion of the overlying soft tissues, when the form of the new bone is far from normal. Figure 16 shows the condition of the bone in this case before the subgingival operation. Although there had been considerable loss of bone, the apical portion of the cortical layer had remained unchanged: it came to an abrupt end at the bottom of the pocket. Figure 17 shows the condition of the bone in 1928. The new cortical layer had united perfectly with the original apical portion.

Figure 18 is a case wherein the destruction and decalcification of the bone had extended beyond the end of the root of an upper right central incisor the apex of which was badly resorbed, the pulp remaining vital. This tooth was operated on subgingivally in 1925, with the result that the pocket was obliterated without causing any further recession of the gum, and the tooth became surprisingly firm. Figure 19 shows a roentgen-ray film of the tooth made in 1928. At that time, there was sufficient bone to support the end of the root, and the reattached connective tissues added much additional strength. Figure 20 shows the present appearance of the tooth and its surrounding gum tissues.

Paradentology is no longer the backward branch of dentistry.

Subgingival surgery should not be limited to the treatment of incipient gingival lesions.

The technic of subgingival surgery can easily be acquired. The operation is gentle, seldom requiring the use of a local anesthetic, and the healing is so rapid that any slight discomfort from the operation subsides quickly. The reunion of the connective tissues with the cementum obliterates the septic pocket, retains the margin of the gum where we find it and restores the shallow gingival sulcus.

Surgical removal of separated gums and a portion of the underlying bone, in the treatment of paradental septic lesions, has had its counterpart in other branches of dentistry. Within the lifetime of practicing dentists, we have had the spacing of the teeth by cutting off all of the contact points, the extraction of the first permanent molars before the second molars were due to erupt, the wholesale destruction of pulps and excessive removal of bone in exodontia.

The cases presented in this paper are typical in results of those secured year after year since 1903, when rapid healing and complete obliteration of deep, septic, paradental pockets furnished convincing evidence that the tissues had become organically reattached by the cementum. Several of these advanced septic cases have been examined from time to time for nearly thirty years after the subgingival treatment. Thus far, they are in an excellent state of health.

FIXED RECONSTRUCTION OF A PROGNATHIC CASE INCLUDING ORTHODONTIC TREATMENT

By MILTON G. WALLS, D.D.S., and FLOYD L. WENTWORTH, D.D.S.,
St. Paul, Minn.

THE empire of the human body is a powerful one, sensitively governed and well equipped to resist unfavorable forces from the outside. Yet insurrection in one of the interdependent states may cause the most serious unrest in the others. Scientists of every branch have come more and more to believe that the teeth comprise a danger zone which threatens the peace of the entire organism.

Recently, as melancholy a failure on the part of nature to provide for her own needs as has ever been seen came to our attention. The patient, a woman of 22, was sent in by her physician, who felt that certain digestive disorders might be caused in part by the inadequacy of the teeth to perform their proper function.

This inadequacy could hardly be exaggerated. The patient was a marked prognathic type and, owing to early extractions, had decreased depth of the bite, which greatly increased the existent malocclusion, as well as detracting further from the appearance.

As shown in Figures 1-2, the maxilla presented the usual prognathic type of arch, showing lack of development in the anterior portion and the extremely narrow vault, but with all teeth present except the right lateral incisor. Clinical examination of the mandible showed that it also held true to type, but with no teeth posterior to the first bicuspid on the right side and, on the left side, the second bicuspid and first molar absent.

Centric occlusion permitted contact between the distal cusps of the lower second molar and the upper first molar on the left side. This was the only occlusion that permitted contact between the two jaws in any of the excursions of the mandible.

The effect on the patient's personal appearance was extremely unfortunate. The protruding chin gave to the lower part of the face a look of heavy, almost brutish belligerence that was not in accord with her temperament. The inferior ridge of the mandible was almost a straight line from the condyle to the symphysis, the angle being almost entirely obliterated. This discrepancy of facial characteristics was extremely arresting.

There were three distinct aspects to the problem presented. There was first of all that of pure dentistry, the reconstruction of the mouth and the balancing of the occlusion to satisfy more nearly the ideal conditions of natural teeth as shown by Dr. Munson's studies of the theory of the spherical principle of occlusion. There was, secondly, the aspect which was related to medicine: that of providing the means for proper mastication of food, the lack of which had been seriously undermining the patient's health. There was, thirdly, the aspect which was related to plastic surgery: that of restoring a more nearly normal appearance to the facial contour, which had been blurred and distorted by the conditions that had prevailed during the developmental years.

The patient's history, as she was able to give it, accounted only in part for the abnormal condition of the mouth. A series of extractions in her younger days explained the missing teeth on the left side of the mandible and the first and second molars on the right side, but there remained a certain mystery about the absence of the right second bicuspid and third molar.

Roentgenographic examination (Fig. 3) revealed the second bicuspid lying horizontally, with the crown toward the distal aspect, while the third molar tooth was impacted with the crown pointed in a mesiolingual direction.

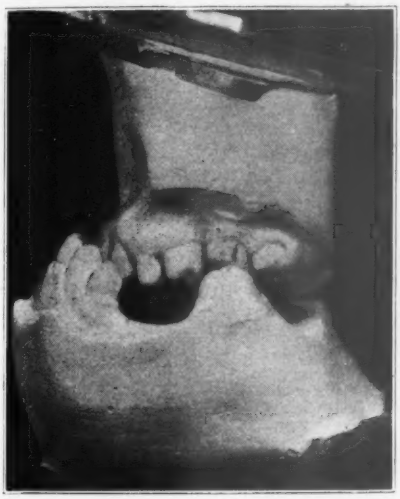

Fig. 1.—Left side of case as presented. The only occlusion was between the upper first molar and the lower second molar.

Fig. 2.—Right side of case as presented.

Two alternative treatments were possible: practically complete extraction and building of dentures or a resort to orthodontic treatment in an attempt to bring into position the two impacted teeth, with the task of developing the maxilla and positioning all teeth as near the norm as possible. The latter method of reconstruction was decided on.

The first step of the work was to raise the bite to clearance in order that intermaxillary rubbers could do their work. This was accomplished by building a fixed bridge on the lower left side from the first bicuspid to the second molar. This bridge was to remain as a permanent unit of the reconstruction and accordingly was built up to an arc. In other words, the vertical dimension for this bridge was determined by setting the case on a Monson articulator and building the segment to an arc of a 4-inch radius. Then a cast gold splint was made for the left maxillary teeth. This was not carved with cusps and grooves, but left smooth and conformed to the arc of the lower. The purpose of this was to give the same plane of occlusion as the change in intermaxillary relationship took place. Figure 4 shows the case built to this point.

The next part of the work was to re-

quire more time. First, it was necessary to remove the bone from the impacted teeth so that they might be pulled up to position.

Immediately after the opening of the bite, which was the first important step in the reconstruction of the case, appliances were placed to establish the proper relationships between the maxilla and the mandible. This necessitated the placing of labial appliances on the maxillary teeth, to be used as anchorage. The four anterior teeth and first permanent molars were used for this. A lingual arch was also used to get the proper width in the posterior region.

Labial appliances were placed on the mandibular cuspids and the right first bicuspid. The left first bicuspid was used as an abutment for a bridge. Buccal tubes had previously been soldered on the molar crown of the lower left second molar for anchorage for the labial arch. Also, a half round tube was soldered on the lingual for the lingual arch attachment. The lower labial arch was then placed, and the remaining anterior teeth were ligated to it for additional anchor-

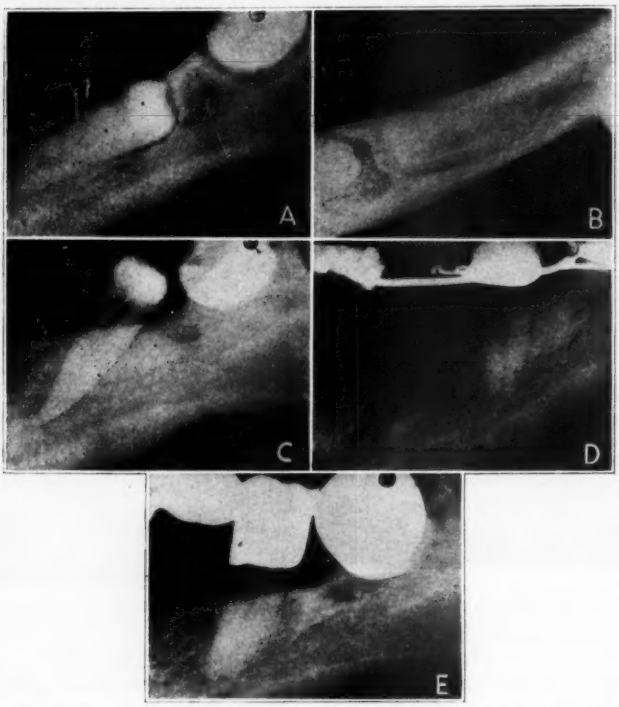

Fig. 3.—*A*, impacted teeth in lower right side. *B*, occlusal view of lower right side. *C*, impacted teeth partially erupted, ready for orthodontic appliances. *D*, impacted teeth moved to final position. *E*, reconstruction completed on impacted teeth.

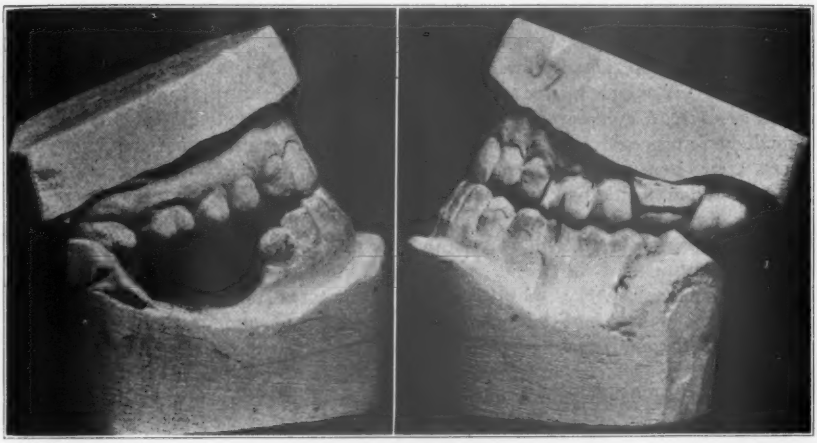

Fig. 4.—Right and left sides with lower left bridge built to arc and splint cemented to left maxilla.

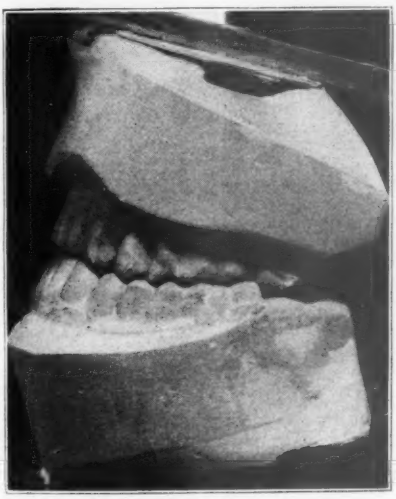

Fig. 5.—Left side of completed case.

Fig. 6.—Right side of completed case.

age. Intermaxillary hooks had been soldered on the lower labial arch in the region of the bicuspids, for the attachment for the binders which were to retrude the mandible.

After the appliances were placed on both the maxilla and the mandible, the mandibular process was removed from the crowns of the right second bicuspid and right third molar. These teeth were

completely covered by the process as shown in Figure 3*A*. An impression was then taken of the exposed crown of the second bicuspid, which proved to be the mesial surface. A gold cap was cast and a small hook was soldered to this cap to afford attachment, by which the tooth could be raised. This cap was then cemented to the crown of the tooth. A lingual arch was then fitted, extending from the abutment of the bridge on the left side (molar crown) to the first bicuspid on the right side. This arch was made of 0.040 round wire and extended distad from the bicuspid about one-half inch. A piece of 0.025 round wire was soldered to the end of this, which was curved to a 30 degree angle, just above and mesiad from the hook on the gold cap. In four months, this tooth was elevated to the position shown in Figure 3*C*. The gold cap was then removed and replaced with a bracket band.

The labial arch was then extended to this tooth and placed in position in the bracket. A small round wire (0.025) was soldered to the end of the labial arch and extended to the distal and lingual surface of the lower right third molar, which had partially erupted during the foregoing treatment. After some time had passed, enough of the crown was exposed to enable the fitting and placing of a molar band with a lingual arch attachment. With this lingual arch, the tooth was then moved to an upright position to be used as an abutment for the bridge. The bridge was then made, including as abutment teeth the cuspid, bicuspids and third molar. This completed the work as far as orthodontia was concerned. The mandible and maxilla were in proper relationship to one another, the proper width had been obtained in the posterior region of both arches and the impacted teeth were in an upright position, ready for the bridges.

Fig. 7.—Left: Appearance of patient at beginning of treatment. Center: Case completed, two years later. Right: Appearance of patient four years after beginning of treatment.

With the teeth moved to as nearly a normal position as possible for the orthodontist to obtain, the rest of the reconstruction was accomplished in the following manner:

A fixed bridge was built on the lower right side from the cuspid and first bicuspid to the second bicuspid, which was brought into the position of the first molar, and then on to the third molar as shown in Figure 3*E*. It was built to the

same arc as the bridge on the left side.

The work on the maxillary teeth was accomplished by merely building the individual teeth to the occlusion which had been established by the first bridge and splint.

Figures 5-6 show the casts of the completed case. Figure 7 shows the profile of the patient at the beginning of the work and two years and four years after the beginning of the work. The beginning of a definite angle of the mandible, caused by the laying down of bone to care for the new stresses, is seen.

The esthetic value of the operation has been great. The lower jaw has been brought back a full half inch, with the result that the heavy appearance has been considerably modified. Previously, the protruding jaw so completely dominated that no other facial characteristic was noticeable. A stolid, phlegmatic look masked all other interest in the face. The jaw, which is, of course, still of the square type, now has a free movement, reflecting the characteristic variety of expression.

This feature of a dentist's work has its very great importance. No one knows the amount of psychic damage that has been done by the covert impulse of a patient to try to conceal a bad set of teeth. The inhibiting influence has undoubtedly destroyed many a temperament that might otherwise have been open, expansive and communicative.

Finally, the patient's general health has been greatly improved by the fact that, for the first time in her life, she has adequate means of preparing food for the digestive processes. The patient has become in all ways better adjusted to the ordinary problems presented by the daily routine.

The case proves conclusively the value of a roentgenographic examination and the use of fixed reconstruction when possible. It is necessary to obtain balanced occlusion if the work is to be expected to withstand the stresses put upon it.

GENERAL ANESTHESIA FOR DENTAL SURGERY*

By W. HARRY ARCHER, D.D.S., Pittsburgh, Pa.

BOTH local and general anesthesia have their specific indications and contraindications in dentistry. Dental schools that do not teach both are remiss in their obligations to their students, the future dentists, and the public.

Thomas Connor, in his survey of education in general anesthesia,[1] ascertained that twenty schools, more than 50 per cent of the dental schools in this country, do not require their students to administer general anesthetics. Yet these dental schools undoubtedly require their students to labor long and hard over many mechanical processes, most of which will be turned over to a dental laboratory a year or two after they have started to

*From the Department of Anesthesia and Exodontia, School of Dentistry, University of Pittsburgh.

*Illustrated clinic lecture given at the Seventy-Sixth Annual Session of the American Dental Association, St. Paul, Minn., Aug. 9, 1934.

1. Conner, Thomas: Status of Present Day Education in General Anesthesia, J.A.D.A., 19:1931-1934 (Nov.) 1932.

practice. The administration of a dental anesthetic cannot be sent in a box to a dental laboratory for completion: it is a very personal service rendered to the patient by the dentist or his trained anesthetist. Dental schools should give their students basic training in anesthesia and should require them to administer general anesthetics and operate under them.

The least they should do is to give their students a comprehensive theoretical course. From a survey that I made of the bulletins of the dental schools in this country, it was ascertained that the majority of the schools made no attempt to

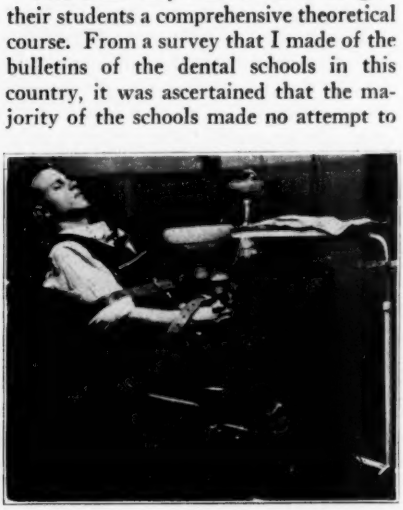

Fig. 1.—Position of patient. Head, neck and chest should be in the same plane, tight clothing loosened. Restraining straps are placed on all men as a matter of routine, after loss of consciousness, being removed just before the return to consciousness. The strap across the chest is loose; those across the lap and over the hands and around the legs are tight. No form of restraint is used in the case of woman patients.

give more than three or four lectures on general anesthesia, and these were given with the oral surgery lectures.

The same schools devote countless lectures and laboratory hours to the mechanical phases of dentistry. If dentistry is to be honestly a health service, the schools must give their students more training in dental surgery and anesthesia, as this phase of dentistry directly and vitally concerns the health of the public.

It has been said that this subject has been deliberately slighted in many schools because the head of the department was a local specialist who labored under the incorrect impression that to become proficient in anesthesia and exodontia, the students must take postgraduate instruction. Students should be as thoroughly trained in local anesthesia and exodontia as they are in prosthesis or operative dentistry. When they reach an economic position which enables them to have an assistant and they desire to include general anesthesia to their armamentarium, they should have special additional training and experience in administering and operating under this form of anesthesia.

I agree with Dr. Connor that students, and I add general practitioners, should "definitely understand that a degree of doctor of dental surgery does not mean that they are anesthetists, nor does it bestow upon them the moral right to administer a general anesthetic without having had sufficient training in that field."

The Pennsylvania State Board of Dental Examiners recognizes the fact that a dentist can legally administer anesthetics without having demonstrated his fitness except for his ability to answer a few theoretical questions, and they have incorporated in their practical examinations the requirement that students shall demonstrate their ability to use and operate under both local and general anesthetics.

This board recognizes the responsibility that has been placed on it by the state; namely, to determine that candidates for a dental license have been sufficiently trained that they may be entrusted with the health and welfare of the citizens of that commonwealth. Other state boards

would do well to include this practical examination in exodontia and anesthesia in their tests; for what phase of dentistry is more fraught with danger to the patient than anesthesia and surgical operations?

For those operations which are performed in the dental office, nitrous oxide and oxygen is the general anesthetic of choice. The use of ethylene and oxygen is fraught with the danger of explosion in an environment which contains such a variety of potential sources of electric sparks. Intravenous anesthetic agents have been introduced with alluring possibilities, but further studies of these agents are advisable before they can be recommended for routine usage in the dental office. Those anesthetics control of which is lost once they have been injected, such as evipal and avertin, should most certainly be used judiciously and only in a hospital where constant supervision of the patient may be had. The Council on Dental Therapeutics several years ago pointed out the dangers inherent in this type of anesthesia. Practitioners will do well to ascertain whether such products have been accepted by the Council. Ethyl chloride, carefully administered on an open mask, may be used for children up to 12 years of age with comparative safety. Ether should not be used in the dental office unless one is prepared to keep the patient in bed overnight. Chloroform, it is universally agreed, does not have any place in anesthesia.

The administration of a drug for the purpose of producing narcosis is not a simple, safe and easy procedure, to be entrusted to the hands of improperly trained persons. The gaseous anesthetics are the safest and yet the most difficult to administer because of the ease with which the gases diffuse through the epithelial wall of the alveoli into the blood stream and the freedom with which these gases are liberated from the blood stream.

Fig. 2.—Nasal inhaler held in position by thumb, fingers of same hand holding mandible up. This leaves the other hand free to adjust the machine or operate the suction tube, which is lying over the patient's shoulder. The anesthetist's hand covers the handles of the mechanical prop, helping to keep it in place.

A dentist desiring to administer nitrous oxide-oxygen anesthesia in his office should take a special course of training in this art at a recognized teaching institution before atempting to use it. Thus and thus only will he be able to avoid the

pitfalls, disappointments and tribulations which are the lot of the man who takes a one-half or one day's instruction from the salesman of gas-oxygen apparatus.

Criticisms of the technic of certain dentists who administer general anesthesia in their offices by members of the medical profession and the laity frequently reach my ears. With a public which is becoming progressively more intelligent about medical and dental science, it behooves us to correct these deficiencies in our knowledge, improve our technic so that we can administer anesthetics more intelligently and not open ourselves to justifiable criticism from the medical profession or the public. The most frequent criticism is that the dentist takes any and all patients, administers the anesthetic and performs the operation with absolutely no knowledge of the patient's physical condition other than the fact that he was able to walk into his office.

I maintain that criticism leveled against such a procedure is justifiable. It is a reflection on the intelligence of the dentist for him to assume that the ability of the patient to walk into his office automatically makes him a fit subject for general anesthesia and authors of articles dealing with general anesthesia should stop making statements to that effect, as it gives the uninitiated a false confidence which encourages him to anesthetize patients who are not fit subjects for general anesthesia. The patient who is able to "walk up a flight of steps" may be a very bad risk for general anesthesia. For

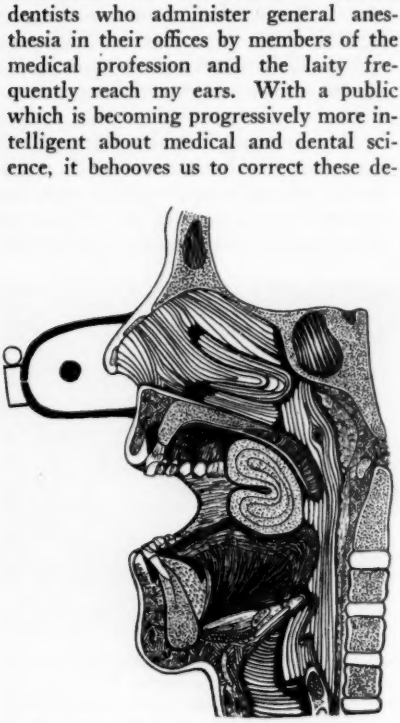

Fig. 3.—Sagittal section of head showing correct location of oropharyngeal partition (so-called mouth pack or throat pack). The lower border of the nasal inhaler is midway between the base of the nose and the vermilion border of the lip. A common mistake is to pull the nasal inhaler up against the nares, which effectively shuts off the flow of gases.

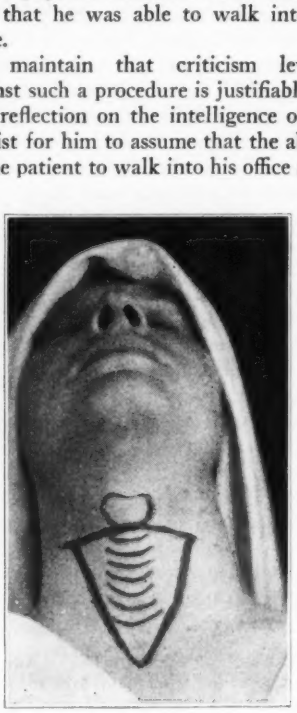

Fig. 4.—Thyroid cartilage (Adam's apple), rings of the trachea and Jackson's "tracheotomic triangle" outlined on neck.

example, he might have active tuberculosis or acute or subacute upper respiratory infection or subacute bronchitis; he might have definite cardiac decompensation or be in the second stage of cardiac failure, or he might have an uncontrolled diabetic or a potential hyperthyroid condition or a nephritis.

Of what use is it to train and educate dental students for six years in basic medical subjects, such as anatomy, histology, physiology, materia medica and therapeutics, if they are not taught to apply that knowledge for the benefit of their patients? And where better can this knowledge be used than in making an intelligent physical survey of the patients before inducing general anesthesia or performing extensive surgical operations in the oral cavity under either local or general anesthesia? Dentists who did not have the advantage of training in the subjects mentioned above can readily correct the deficiency by taking postgraduate instruction.

Most dentists before making extensive restorations will carefully roentgenograph the remaining teeth and their investing structures; run study models of the case and articulate them, and make drawings in order to figure stresses and strains; and after careful, thoughtful planning for the type and construction of the appliances, they will turn around and carelessly administer an anesthetic and extract the necessary teeth with absolutely no physical survey or knowledge of the patient's condition.

Dental patients are treated as inanimate objects in all too many cases. Whether this is because of the mechanical training in the laboratory, working with stone and metals, I do not know, but it is a certainty that the physical condition of the patient is disregarded all too often.

Fig. 5.—Making trachea prominent by pressing back soft tissues on either side. The soft tissue is then incised down to the trachea. The tracheal corrugations are palpated with the index finger and the trachea incised below the first ring.

An essential then for intelligent anesthesia is a physical examination of the patient, not for the purpose of diagnosing accurately his condition, but sufficiently broad to obtain some idea that will guide the operator in administering an anesthetic or will advise him as to when to refer the patient to his physician for his opinion.

McKesson wrote an excellent article

entitled "Influence of Certain Diseases on Technic and Other Considerations of General Anesthesia in Exodontia."[2] Can we apply the knowledge of variation in anesthetic technic if we have not predetermined what the physical status of the patient is?

We are careful to tell our patients that we are not attempting to make an exact physical examination, that being the physician's field, but are merely checking them over to ascertain in general how they are. If, in making this survey, we find anything that arouses our suspicion, we will refer them to their physician for an opinion before proceeding with the anesthetic.

The objection has been raised that such a procedure is unnecessarily alarming to the patient. I doubt that any patient approaches general anesthesia with perfect equanimity. It is true that some patients are alarmed, but it has been our experience that the greater percentage of them have their fears allayed and their confidence increased in the operator and in their ability to take a general anesthetic safely by a preliminary examination.

This examination should include taking the temperature and the blood pressure, a breath holding test, auscultation of heart and the taking of a short medical history designed to elicit any possible clues regarding cardiac or respiratory disease or systemic disorders.

A careful examination of the oropharynx with a mouth light and mirror is of course included. This examination should include the pharynx and larynx. The larynx can be exposed to view by grasping the tongue with a towel, drawing it forward and having the patient say "ah." At the same time, the combination mouth mirror and light are inverted over the larynx and the epiglottis and the vocal cords may be seen in the mirror.

Chevalier Jackson declares that "every adult patient should be examined with a

Fig. 6.—Tracheotomic tube in position. Artificial respiration is performed by placing the nasal inhaler over the external opening of the tube and inflating the lungs with a mixture of 90 per cent oxygen and 10 per cent carbon dioxide from the machine. The lungs are inflated with this mixture and then deflated by hand pressure on the chest wall and diaphragm not faster than twelve to fifteen times per minute.

2. McKesson, E. I.: Influence of Certain Diseases on Technic and Other Considerations of General Anesthesia in Exodontia, J.A.D.A., 16:18-26 (Jan.) 1929.

throat mirror before general anesthesia for any purpose."[3] Such an examination will reveal any benign or malignant growths in or about the larynx, the presence of which may result in mechanical respiratory embarrassment during anesthesia.

During this physical survey, the dentist will have studied his patient and decided whether he needs preanesthetic medication and, if so, what type. We do not routinely employ premedication, as, in many instances, it results in postoperative nausea and delays departure from the office.

impassive patients is misinterpreted if routine preanesthetic examinations are not made.

When it is apparent that sedation is needed, I prefer to use one of the accepted members of the barbital group, such as barbital soluble U.S.P. in doses of 0.5 gm. (8 grains), in the form of powder to be given in hot fluid, such as hot milk, half an hour before bedtime or before operation.

If it has been decided to use a general anesthetic and no contraindications have been found, in addition to premedication where indicated all patients should have

Fig. 7.—Wrong place to incise for tracheotomy. Incision should never be made through or above the thyroid cartilage.

Profound psychic disturbances result from fear, excitement and apprehension, and not a few cases are on record in which the resultant mental shock has resulted fatally. Many operators are deceived by the outward calm of the patient, who actually is quaking within. The true state of his mind is readily ascertained when one places the stethoscope over his heart and notes a very rapid rate. The condition of these seemingly

the system thoroughly alkalinized by taking, for two days preceding the operation, copious draughts of orange or grapefruit juice to which glucose has been added to supply excess glycogen to the liver and prevent postanesthetic acidosis.

One must keep in mind that his office patients expect to be ambulatory a short time after the operation is completed; hence, the doses mentioned are minimum. The thoughtful practitioner will remember, incidentally, the warning sounded by the Council on Dental Therapeutics that "addiction to barbitals for the sinister

3. Jackson, Chevalier: Bronchoscopy and Esophagoscopy, Philadelphia: W. B. Saunders Company, 1927.

purpose of narcotic pleasure and enjoyment is a recognized evil."[4]

The physical and psychical requirements of the patient having been satisfied and all preparation having been completed, the patient is seated in a properly adjusted chair, and the rubber apron and towel are placed. Restraining straps are not placed on women patients and not on men until they have lost consciousness. They are placed on all men as a matter of routine—"an ounce of prevention is worth a pound of cure." (Fig. 1.)

The matter of the type of restraining strap is optional as long as untoward movements of the patient are prohibited without embarrassing the respiratory movements. Where a restraining apparatus is placed across the patient's chest, care must be taken not to tighten this strap to the point of restriction of normal respiratory excursions. Recently, several new types of restraining apparatus have been placed on the market which are quite excellent, but they do not restrict the movement of the patient's torso, and such restriction is a necessity. The anesthetist turns on the gas apparatus and places the nasal inhaler over his own nose to demonstrate to the patients what they are to do. Several breaths are inhaled and exhaled through the inhaler by the anesthetist, and the inhaler is then placed over the patient's nose and the latter is instructed to breath regularly and normally through the nose. To avoid a feeling of suffocation, positive pressure of the nitrous oxide is delivered and the exhaling valve is adjusted to open freely.

When inducing anesthesia, we do not prop the patient's mouth open. The reasons for this are: (1) a patient whose mouth is too widely opened is made uncomfortable; (2) many patients find it difficult to breathe through the nose when the mouth is open; (3) it becomes necessary to use some form of a cover over the mouth in an effort to prevent the dilution of the anesthetic gases with air; (4) this delay in opening the mouth has the additional advantage of assuring us that the patient is in the second stratum or normal plane of the third or surgical stage of anesthesia, in which the muscles are relaxed. If, on attempting to place the gag or prop, we find that the muscles of the mandible are rigid or contracted, we know that the patient is in the profound stage of anesthesia approaching the overdose stage, and the anesthetist lightens the anesthesia. On the other hand, if the attempt to place the gag or prop results in the reflex muscular movement observed in light anesthesia, the anesthetist deepens the anesthesia.

Many operators prefer to induce anesthesia with the facial mask and then switch to the nasal inhaler. My objections to this method are: (1) it gives the average patient the idea that, to avoid suffocation he must breathe deeper and faster, which naturally results in greater apprehension, and (2) it encourages mouth breathing. As anesthesia must be maintained via the nasal passage, we feel that it is desirous to obtain and maintain anesthesia via this route rather than to attempt to change the route of the gases after the patient has lost consciousness. Incidentally, one might be embarrassed, after the patient has lost consciousness, to find that the latter was possessed of a nasal abnormality which prohibited him from breathing freely through the nose. We induce anesthesia with 100 per cent nitrous oxide, the reason being to shorten the induction period. From the very first breath taken by the patient, the anesthetist, in a low modulated tone, speaks words of encouragement and praise to the patient. Noise in the operating room

4. Uses and Abuses of the Barbitals, J.A.D.A., 18:152 (Jan.) 1930.

during the induction period is of course strictly forbidden.

The average induction period is shortened too much and the average operator starts to operate too soon. It takes time to place the patient in the normal plane of anesthesia, and the anesthetist should take the necessary time to obtain the desired plane of anesthesia before permitting the operation to start. The haste of the operator is undoubtedly a hangover from the days in which the patient was "knocked down" with straight nitrous oxide until they were "blue," at which time the dentist "ripped out" the teeth before the patient regained consciousness. Today, such haste is a reflection on the ability of the dentist and the technic of the anesthetist.

During the induction period, the respiratory rate is our guide. Just as soon as an increase in the respiratory rate is evident, 5 per cent oxygen should be added to the mixture. If this amount is sufficient, the respiratory rate will become less; if not, the rate will continue to be rapid, with labored respiratory excursions and stertor. These signs call for more oxygen; hence, the valve supplying the oxygen should be slowly opened so as to increase the oxygen supplied to the patient until the latter manifests the signs of a normal plane of the surgical stage, which are a regular rhythmic respiratory rate, the volume of the inhalations and exhalations being practically equal, with no phonation or sobbing.

The muscles are relaxed, the reflexes absent. The patient's arm may be moved freely. The eyeball is usually fixed within a central or eccentric position. The pupil is contracted.

While color is the least important sign of anesthesia, it should be observed along with the other signs in determining the plane of anesthesia. The fact that, with anemics, there is no color change except a slight darkening of the lips and that, with plethorics, there is marked cyanosis, even though in both these cases the patient is getting all the oxygen necessary to maintain the vital functions, should not be lost sight of by the anesthetist.

When the normal plane of anesthesia is established, the anesthetist so informs the dentist, who now places his mechanical prop, opening the mouth sufficiently to permit operating (Fig. 2) and yet not so wide as to force the mandible down and back, thus encroaching on the airway and embarrassing respiration. One must also remember that it is easier to dislocate the mandible under anesthesia by extensive separation of the mandible from the maxilla. If this has been inadvertently done, the patient will be unable to close as he regains consciousness. This condition can be corrected by wrapping both thumbs with a towel and placing them over the occlusal plane of the lower molars, creating pressure downward and backward. This pressure will move the condyle down over the eminentia articularis and back into its normal position in the glenoid fossa. The oral cavity being exposed to view, the operator places the so-called "mouth pack," which has been more appropriately called the throat curtain, by Feldman.[5] The purpose of these gauze or cotton dressings is to partition the oral cavity from the pharynx for the dual purpose of preventing the dilution of the anesthetic gases on their way from the nasal cavity through the pharynx into the larynx and the lungs and to prevent the aspiration or swallowing of blood and mucus, or even teeth or particles of tooth structure.

5. Feldman, M. H.: Consideration of Advisability of, and Measures Favored for, Protection of Oropharynx During Dental Operative Procedures, D. Digest, 36:446-448 (July) 1930.

I do not agree that one of the primary functions of such a partition is to absorb the blood. This should be removed by the suction apparatus, a very necessary piece of equipment in operating under general anesthesia in the oral cavity.

The construction of the pack and the material used to accomplish these purposes is optional with the surgical team using them. Some men employ large, medium and small "snowballs" of cotton, selecting the size necessary for the case at hand. I have been annoyed so much with the cotton fibers becoming entangled with carious teeth or with the beaks of the forceps that I have abandoned this device. Then there are the prepared commercial packs. My objection to these is that they are not readily adapted to the soft tissues of the oral cavity, their use permitting too much leakage of both air and blood.

A pack made by enclosing a piece of wood pulp paper between layers of gauze forming a package about 2 inches wide and 6 inches long and less than a quarter inch thick, which is then folded back and forth across the posterior part of the oral cavity to build an efficient partition, works very satisfactorily. To prevent a loose end of this pack from dropping into the pharynx and over the larynx, the first end is folded under the tongue, the other end along the cheek.

Cotton may be used instead of paper as described above. The whole pack is dampened before it is inserted and thus makes not only a less irritating throat curtain to the mucous membranes, but one which is 100 per cent more efficient in prohibiting the passage of air, which results in dilution of the anesthetic vapors. As we have just seen, this is the most important function of this temporary partition between the oral cavity and the pharynx.

The location of the partition is important. It should be so placed that the base makes contact with the dorsum of the tongue, the sides being just anterior to the right and left anterior pillars of the fauces and the top at the junction of the hard and soft palate. (Fig. 3.)

The term "throat pack or mouth pack" is incorrectly used in dental anesthesia. To students, it presents the idea that they must pack gauze or some other material into the pharynx, the very thing that should be avoided.

At Pittsburgh, we call this barrier the oropharyngeal partition, which we feel is a more exact descriptive term.

Death under nitrous oxide-oxygen anesthesia is due to asphyxia in 90 per cent of the fatalities. This fact being accepted, it behooves one who is administering anesthesia with these gases to be very familiar with the causes of asphyxia and their treatment.[6]

There are some cases in which operation should not be performed in the dental office; for example, where there is extensive induration of the soft tissues of the neck and the floor of the oral cavity, which are encroaching on the air passages, either owing to pressure on the trachea or edema of the trachea itself, and which will offer even a greater obstruction to the free ingress and egress of the anesthetic gases, once the patient has lost consciousness to the point where complete stoppage of the air passage might ensue. A mechanical airway such as an intratracheal tube should be used. One should also be prepared to perform an emergency tracheotomy if mechanical difficulties are such that intubation is impossible. An ideal tube is that described

6. Archer, W. H.: Exhaustive Survey of Causes of Mechanical Respiratory Embarrassment During Nitrous Oxide-Oxygen Anesthesia for Dental Surgery, D. Cosmos, 76:1233 (Dec.) 1934.

by Woodbridge,[7] of flexible metal, the shaft of which is made of closely coiled phosphorbronze wire with rigid tubing on both ends. The whole tube is covered with Pemore rubber to make it gas tight. Although designed to be used during the removal of large intrathoracic goiters, it may also be used for any case in which an intratracheal catheter is to be passed through the mouth. A hollow straight stilet serves to keep the tube rigid while it is being passed into the trachea. After the tube is placed, we can close the system by packing with gauze which has been moistened or impregnated with petrolatum and send the gases through this tube.

This tube is particularly advantageous for oral operations, as it can be bent sharply without kinking; which permits it to be angulated sharply toward the ear at the point where it emerges from the mouth, and thus keeps it out of the surgeon's way.

Large abscesses in the retropharyngeal area have ruptured spontaneously into the trachea from manipulation of the head and neck during anesthesia, resulting in death of the patient from sheer asphyxia, drowning as a result of the aspiration of the pus. When the intratracheal tube is being used, this emergency can be coped with by inserting into the lungs via this tube a small rubber tube attached to a suction apparatus which will aspirate the contents of the lungs.

A life-saving operation which has been neglected in articles and textbooks dealing with general anesthesia is the emergency tracheotomy. In operating in the oral cavity, the danger of aspirating some object such as a sponge, which will result in complete stoppage of the air passage, is ever present. Many cases have been reported to me by dentists in which life was saved by this operation,[8] and I have knowledge of others in which death ensued as a result of failure to perform this operation. Naturally, these cases are never reported in the literature. Bonney[9] reports one case in which death was narrowly averted when a throat pack slipped into the larynx.

In any office where general anesthesia is administered, there should be a No. 5 tracheotomy cannula and a Trousseau dilator, and the dental surgeon should be able to use them. The other instruments necessary for the performance of an emergency tracheotomy are present in every office equipped for dental surgical operations: scalpel, hemostats, small retractors, tenaculum, aspirator, probe, sponges, and a tank of oxygen, with a good source of light.

The following description of a tracheotomy is a combination of Chevalier Jackson's, "Résumé of an Emergency Tracheotomy," and "Regular Tracheotomy," with a few additions and illustrations of my own, with the thought that the tracheotomy is being performed in the dental office. Dr. Jackson's book "Bronchoscopy and Esophagoscopy" should be read by every man administering general anesthesia.

The following should be memorized:

1. The essentials are: knife and pair of hands (but full equipment is better).
2. Do not perform a laryngotomy (stabbing).
3. A "two stage, finger guided" operation is better.
4. Place the patient in a horizontal position, head and neck lower than chest,

7. Woodbridge, P. D.: Flexible Metal Tube for Intratracheal Anesthesia, Cur. Res. Anes. & Anal., 13:68-70 (Nov.-Dec.) 1934.

8. Frank, Victor: Case Report and Comment on Emergency Tracheotomy, D. Cosmos, 77: 514 (May) 1935.

9. Bonney, T. C.: Foreign Bodies of Dental Origin in Air Passages and Lungs; Review of Literature, with History of Ten Cases, J.A.D.A., 21:276-288 (Feb.) 1934.

with a sandbag or substitute under the chest.

5. Press back the danger lines with left thumb and middle finger, making the safety line and trachea prominent.

6. Memorize Jackson's tracheotomic triangle. This is a triangulation of the front of the neck intended to facilitate an emergency tracheotomy (Fig. 4): apex at suprasternal notch; sides, anterior edge of sternomastoids; base, horizontal line, lower edge cricoid.

7. Paint skin with a germicidal solution.

8. Incise exactly in the middle line below the "Adam's apple" (thyroid cartilage) to the sternum. (Fig. 5.)

9. Feel for the tracheal corrugations with the left index finger in the pool of blood, following the trachea with the finger downward from the superficial Adam's apple.

10. Pass the knife along the index and incise the trachea below the first ring (not too deeply as the posterior wall may be cut).

11. Don't mind the bleeding, but keep the middle line and head straight. Keep the head low, and don't bother about the thyroid gland.

12. Spread the incised trachea carefully with the Trousseau dilator, insert the cannula and see it enter the trachea lumen. Make certain that it isn't too short. Remove the pilot. Tie the tapes. Don't suture the wound. Dress with large squares of gauze.

13. Start artificial respiration. Oxygen insufflation will aid in the restoration of respiration. (Here I would like to suggest in addition to oxygen that carbon dioxide to be added to the oxygen (not over 10 per cent). This mixture of 90 per cent oxygen and 10 per cent carbon dioxide can be permitted to inflate the lungs by means of placing the nasal inhaler over the external opening of the tube. (Fig. 6.) Jackson warns against excessive pressure of oxygen to avoid producing ischemia of the lungs.)

14. A pearl of amyl nitrate is broken and allowed to mix with the oxygen by placing it under the nasal inhaler, but not over the tube.

15. Practice palpation of the neck until the trachea landmarks are familiar.

16. Practice the foregoing technic up to the point of incision, at every opportunity. Do not incise through or above the thyroid cartilage. (Fig. 7.)

17. Do not use a short cannula, as it may not be long enough to enter the trachea.

Tracheotomy is the only means of circumventing a complete blockage of the respiratory passage and to enable oxygen to be piped down into the lungs to maintain life.

The after-care of the tracheotomic wound is of utmost importance. The patient should be hospitalized and placed in the hands of a physician who has been trained in bronchoscopy and will be the one to eventually remove the obstruction and close the opening into the trachea.

"Slitting the throat" has been fixed in the mind as being synonomous with death. The fact that this operation is life-saving where indicated is not recognized by the unthinking. This vertical incision, when made in the area described, will not invade any vital structures, it is the horizontal "slitting of the throat," severing one of the carotids or the jugular vein, that kills.

A normally breathing patient who suddenly manifests respiratory difficulty, with little or no exchange of gases in spite of labored excursions of the chest wall and diaphragm, followed by asphyxial convulsions and rapidly increasing cyanosis and respiratory failure, and who does not respond to the usual treatment of asphyxia, which is increased oxygen per-

centage, or 100 per cent under pressure, correction of position, removal of the "throat pack" and suction of any blood or mucus, is a fit subject for emergency tracheotomy. The final and most important clue that a tracheotomy is imperative is this:

The facial mask with exhaling valve closed, which should always be kept in the open within arms' reach, has, of course, by this time been substituted for the nasal inhaler. It is closely adapted to the patient's face and the emergency oxygen valve is opened. The assistant should place his hand over the diaphragm and watch the chest wall. If, when the oxygen emergency valve is opened, the diaphragm and chest wall are not forced outward, there is complete respiratory blockage and tracheotomy must be performed if life is to be saved.

Even if we are successful in inflating the lungs by forcing the object deeper, there is still danger, because, as the patient regains consciousness, the cough reflex returns, and we must anticipate the possibility of this foreign object's becoming impacted in the larynx on the reverse journey when the patient coughs it up.

If a patient ceases to breathe, a trying time ensues for the dental surgeon and his staff. It is then that his temperament and training meet the acid test. The pulse should be checked to ascertain whether circulatory stimulants are needed. If the volume or rate is not satisfactory, injection of 7.5 grains of caffeine-sodium-benzoate subcutaneously in the subclavian region or from 10 to 30 grains of camphor in oil or from 5 to 10 minims of 1:1,000 epinephrine is indicated.

CONCLUSION

1. Those men already using general anesthesia should turn the searchlight on themselves to determine whether they have the mental and physical equipment that will enable them to intelligently administer general anesthesia. If not, they should correct their deficiencies.

2. Dental schools should recognize their obligations to the students and the public and teach general anesthesia and be prepared to give postgraduate instruction.

3. Finally, laws should be passed requiring possession of a certificate of training in anesthesia from a dental school before administration of general anesthetics is permitted.

IMPORTANCE OF MECHANICS IN FULL DENTURE CONSTRUCTION

By RALPH McWHIRTER, D.D.S., Allison, Iowa

THE education of the public to demand better dental service has had certain interesting phases, especially as regards full denture construction, reaching a point where esthetics is becoming the paramount issue in the minds of some patients. This is more notably true in the last eight or nine years, or since the advent of the so-called "ites" or vulcanite substitutes. Function remains the primary issue, phonetics being secondary, and natural appearance last, each being closely related or dependent on each other.

We shall consider one thing, mechanics. So-called esthetics will be dismissed, or forgotten temporarily. Esthetics is the science of the beautiful in nature and art. Under mechanics, we will consider only the correct positioning of the teeth, since it necessarily involves other steps, such as good impressions, well-prepared casts and balanced occlusion, which under no circumstances can be neglected.

Few if any dentists were ever requested by a patient to construct a denture for no other purpose than the esthetic. The primary objective of every person when he has become edentulous is to obtain dentures that can be used efficiently and comfortably. The matter of so-called esthetics appears on the horizon, and for this we are partially responsible. If we used the term "natural appearance," many of our troubles would be eliminated.

W. H. Wright,[1] of Pittsburgh, made a general survey of several hundred patients who had worn dentures from three to eighteen months. One of the matters considered was general appearance, under which three questions were included:

1. Do your dentures resemble your own teeth?

2. Are you pleased with the appearance?

3. Do your friends like the appearance?

In answer to these questions, more than 95 per cent of the patients replied that they were satisfied. It is wonderful how kind nature is and what she does for us.

Knowing well the folly of trying to impart a given technic and since my ideas are somewhat unorthodox, I shall brave the controversies and briefly describe them. It is not my intent to convey the impression that they are a 100 per cent; but neither are they based on hobbies and misconceptions.

Every art is based on a few principles. There may be many methods and all of them successful, yet their success depends almost entirely on a few fundamentals that must be followed.

A great number of failures in full denture construction are due to the fact that we have never established the approximately correct height of the lower teeth. Assuming this statement to be correct, it might be well for us to consider what it means to obtain the approximately correct height and the positioning of the teeth over the ridge.

The greater the distance the teeth are vertically from the ridge, the greater the leverage. The same applies to placing them horizontally from the ridge. When we have both these obstacles to contend with, our troubles are multiplied. We have all observed patients who have worn dentures for years with little destruction of the ridge and with good function, and it can be noted, in these cases, that the teeth are placed close to the ridge and over it. Thus, it would seem only obvious that the nearer we approximate this natural position, the better the teeth will function.

Let us assume that we have taken a good impression so that a proper cast can be obtained. We adapt to the cast well fitted baseplates which have been reinforced with a little melted baseplate. These bases must be stable. To add to the stability of the upper baseplate, I always place a piece of heavy metal for relief in the palatal area of the cast; then adapt the base. This will give the trial base nearly as much adhesion as the finished denture will have. I now take a so-called mush bite, with or without the baseplate in position. I mark the casts with bisecting grooves and soap before mounting on the

1. Wright, W. H.: Prolonging Efficiency of Service from Prosthetic Dentures, J.A.D.A., 20:505 (March) 1933.

articulator, to facilitate removing the casts and remounting them. I mount them on the articulator, and, after mounting, open or close the articulator until the ridges in the upper and lower casts are parallel in the bicuspid and first molar region. This bite is not correct merely by accident, for it is to assist in building bite-rims. The lower rim is built up in modeling compound to about the correct height and tried in the mouth.

The approximately correct height to make this lower bite rim is based on the judgment of no less an authority on anatomy than the late H. J. Prentiss,[2] who told us many years ago that the plane of occlusion passes through the mandibular foramen. Assuming this statement to be correct, we use the landmarks for the mandibular injection as a guide. Knowing the point of injection to be about 1 cm., or a little less than half an inch, above the occlusal plane of the teeth in the normal case, I aim to establish the height of the occlusal bite-rim approximately 1 cm., or a little less than a half inch, below this point of injection, thus approximating the occlusal plane employed by nature. This is the most accurate guide for the correct plane of occlusion that I know.

When the lower occlusal plane is established, I build up the upper in compound and try it in the patient's mouth for the correct vertical relation, or jaw separation and centric. Up to the present time, I know of no way to judge the first two relations correctly. This is nothing more than a matter of mechanics and of judgment on the part of the operator. Each of us has a different idea as to the proper opening. Most of us know some of the trouble encountered in opening the bite too much.

In this upper bite rim, I cut a v-shaped groove in the entire occlusal surface about 3 or 4 mm. in depth and leave a thin edge of compound on the lingual and buccal edges. I fill this groove with melted wax and request the patient to make a few excursions of the mandible. It may be necessary to trim slightly where the compound shows through, but, in a short time, it will not be difficult to obtain the approximately correct relation of the jaws. In doing this, it is not the aim to establish the curve of Spee, for I prefer to use a plane that is flat, or nearly so.

I fasten the bases together and remove from the patient's mouth. It is now necessary to remount on the articulator, as the mush bite would not necessarily be correct. Only the upper cast needs to be remounted. If the bicuspid and first molar regions are not parallel, it will be necessary to change the upper bite rim by adding to or taking away; which has to be done in the patient's mouth. This, of course, would necessitate a remounting of the upper cast, but this is quickly accomplished, since the cast, which has been soaped, is very easy to remove.

Our reason for using a plane that is flat, or nearly so, is based on nothing more than mechanics. The application of all the laws and principles of the normal masticating apparatus to dentures is not all that we have been taught to believe. Natural teeth and dentures function under entirely different conditions. Natural teeth are three-fifths embedded in bone, as we all realize, especially when trying to remove some of them. Dentures consist of a certain number of teeth attached to a fixed base, which, in turn, rests on movable tissue. They are mechanical devices, and why should we struggle to establish the spherical occlusal plane

2. Prentiss, H. J.: Regional Anatomy Emphasizing Mandibular Movements with Specific Reference to Full Denture Construction, J.A.D.A., 10:1088 (Dec.) 1923.

when it seems to destroy the very thing that we are trying to accomplish; namely, the utmost stability with efficient function? Natural and artificial teeth are entirely different, one anatomic, the other mechanical.

Having established the approximately correct height of the occlusal bite rims, we are ready for the arrangement of the teeth. We know that asymmetry of facial form and of natural teeth is far more common than symmetry, and, in the maxilla and mandible, we never find the two sides the same. It would seem only logical to study this difference before proceeding. The lower baseplate is now removed and a new one adapted and the setting up of the lower teeth to the upper occlusal rim is begun. It is assumed, of course, that a proper selection of teeth has been made for the case. First, the lower anterior teeth are set over the labial crest of the ridge, then the bicuspids and molars are set over the crest of the ridge, to where the ridge ascends. In many cases, it is not necessary to use fourteen teeth, since most cases function better if one or two are left off. I use my judgment, of course, as to which ones to leave out. Since the lower teeth have been set up to a stable and fixed upper occlusal bite rim, I remove the upper base and adapt a new one and proceed to set up the upper anterior teeth, following the ridge contour. In some cases, it will be found that the cuspids or bicuspids are not correct. It then is necessary to decide whether to make a change in the lower or the upper teeth. By a change, I mean leaving one or more out, grinding the mesial or distal aspect or spacing them apart. These changes depend entirely on the case and my own judgment. I set the upper posterior teeth, following the ridge contour. In some cases, there will be an end-to-end bite on one side and an overjet on the other. Of course, it is to be understood that I am speaking of nonanatomic posterior teeth. Nothing has been said about balanced occlusion. This primary essential of all dentures is not so difficult to obtain if a near or flat plane and nonanatomic teeth are used. Neither have we referred to overbite and overjet in the anterior teeth. These are obtained by following the ridge contour, noting the relation of the upper to the lower jaw. It has been my experience that when teeth are tried in, the patient is pleased with the comfortable feeling. This is due to the fact that the tongue is in a nearly normal relationship to the lingual aspect of the lower and upper teeth, and that the lips are not out of natural position owing to the presence of the teeth.

When artificial teeth that have the correct ridge relation are in occlusion, the tongue is not flat, but is slightly curved or crowded. When the jaws are at rest, the tongue flattens out. The lower peripheral border of the tongue will extend slightly over the lingual aspect of the occlusal aspect of the lower. The superior peripheral border lies under the lingual-occlusal aspect of the upper teeth. This makes a comfortable rest position and is one of the conditions dependent on what is termed centric relation.

After noting the lip action and the ease with which the patient speaks, I allow him to express his opinion as to the natural appearance. I never sacrifice function for beauty, unless at the patient's own risk.

In the arrangement of the teeth, it is desired to bring the occlusion as far forward as possible. Sometimes, I think that the cuspids should have an occlusal surface, because the greater the stress-bearing area, the more stable the dentures, and, consequently, the more efficient the function. The idea is to have occlusion throughout, but this is impossible in all

cases. The second molar should always be out of occlusion, if used.

For the sake of argument, let the mandible represent a base of horseshoe shape. It would certainly be illogical to place a load near the ends of the shoe and expect it to carry an equalized pressure throughout. Therefore, I divide this pressure-bearing area, and distribute it over the entire area if possible. It is the aim to have the cuspids in occlusion or what may be termed lingual occlusion, and, when possible, the same is true of the lateral and central incisors.

Dentures are not efficient unless the patient can masticate on the two sides equally well, and that this is one of the first things that the patient reports is more commonly found in persons who have previously worn dentures.

There is a very limited lateral movement in using dentures. It is mostly up and down. When efficient artificial teeth attack a bolus of food of any size, it is taken to either the right or the left side of the mouth and, when it is broken up, the tongue carries part of the food to the opposite side. Then this up and down movement takes place in the bicuspid and first molar region. Thus, the pressure area is equalized and the dentures become more firmly seated.

Certain nonanatomic teeth are made very inefficient by the grinding of the occlusal surface. To avoid this and allow for any change, I finish the lower first. In removing from the flask, I am careful not to mutilate the cast any more than is necessary. After the denture is cleaned up, it is placed back on the cast. As I marked the cast with grooves, it goes back to place on the articulator. Thus, I am able to detect any changes. It is advisable to finish the lower denture and try it in the patient's mouth with the unfinished upper in position, so that, if desirable, changes can be made. The upper is then finished and, with this extra effort, little if any grinding of the occlusal surface is necessary.

The position of natural teeth, especially the anterior, is largely determined by the shape of the maxilla and mandible, which, in turn, helps to determine the facial contour. We are all familiar with the three types of arches: square, tapering and ovoid.

By establishing a nearly correct height for the occlusal surface of the lower teeth, we obtain an approximately correct vertical relation or jaw separation with less difficulty. Thus, if we arrange the teeth according to the ridge contour and use our judgment in regard to the number of teeth to be used and the proper spacing, we can be assured that there is some approach at least to the nearly normal arrangement that nature formerly employed.

The correct positioning of the teeth is one of the very important steps which assure efficient function in dentures. This correct position brings about a coordination between the tongue, lips and muscles which facilitates control of a bolus of food by the teeth. It makes enunciation, which is sometimes very annoying to beginners, much easier. Lastly, so-called esthetics is mechanically taken care of, owing to the fact that the natural appearance has been restored by attention to some of the things that determine facial contour. Also, we owe a debt of gratitude to the manufacturer for producing such natural appearing teeth and for offering such a wide selection. The choosing of artificial teeth to imitate the lost natural teeth is the highest form of art.

Since this technic is not in accord with the general teachings and since there are difficulties encountered in explaining it without a demonstration, it would only seem natural for most men to be skeptical. To be more specific, I would call atten-

tion to the satisfaction that both patient and dentist experience when immediate restorations are employed, owing to the fact that the few principles which we have set forth are then definitely established.

1. With the use of immediate insertions, we are able to maintain the correct vertical relation. The patient is at ease and more comfortable. This mandibular relation is in reality a state of health.

2. It prevents the contraction of abnormal masticatory habits.

3. The denture allows the tongue, muscles and lips to function normally owing to the correct positioning of the teeth. In other words, it places them in the position that the natural teeth occupied.

4. Patients are more satisfied because of the natural appearance and because they do not have to go without teeth.

5. The muscle tone is never lost.

6. It is possible to make the shape of the arch conform to the contour of the cast; which results in conditions necessary for the retention of a denture. This is especially true in the maxilla. When it is possible and the physical condition of the patient will permit, this should be practiced.

Since, in immediate restorations, we have maintained the normal vertical relation and the proper length of the teeth and their natural position, it seems obvious that in full denture construction, by the application of correct mechanics, with judgment, we can assure attention to phonetics and natural appearance and produce the maximum efficient function.

Basically, the principles on which artificial teeth are constructed have changed but little in the last eighty years. Fundamentally, their construction is based on judgment and a thorough understanding of the mechanics involved. I know of no other mechanical substitute for man that is so efficient as teeth properly constructed, but we have not reached Utopia as yet. It is not the things we like to do, but the things we have to do that make life's blessings.

A PRACTICAL METHOD FOR THE EXTEMPORANEOUS PREPARATION OF A BUFFERED ANESTHETIC SOLUTION

By C. H. BURMEISTER, D.D.S., F.A.C.D., Cincinnati, Ohio

Through a reasoned association of available facts, a logical association of thoughts and ideas are brought into being; these in turn evolve a theory; investigation proves the theory to be true—and the story is born.

IN the past few years, the advancement made in local anesthesia has come from an improvement in the solution used rather than from any outstanding advance in technic. Notwithstanding the fact that there has been no paucity, in the literature, of detailed reports on the nature of local anesthetics and their action when used in simple aqueous solution and other proposed vehicles, there has not been available, for general use in the practice of dentistry, the needed "ideal" solution; i.e., one that is stable and that will afford speedy and profound anesthesia, and that will not cause

hemolysis of the red cells or rupture of the connective tissue and fat cells, with the attendant tissue necrosis.[1] Nor has there been a practical method of preparation proposed, to be followed in the doctor's laboratory, that would insure the accuracy and uniformity of the solution required.

The manufacturers continue to bombard dentists with announcements of new local anesthetic solutions, for which they claim all the virtues of the ideal solution. Their entry into the competitive field is made with a blare of trumpets. We review the exhibits, and we may even become a bit festive ourselves, in the hope that our quest is at an end; but the parade is soon over, and we go back to procaine hydrochloride, on whose anesthetic attributes we have learned to lean, and combat the after-effects as best we can.

This would not be necessary, if we could only make practical application of the theories advanced by the research workers. As long ago as 1910, Oscar Gros,[2] of the University of Leipzig (Institute of Pharmacology), in a series of laboratory reports on local anesthetics, including novocaine, and their reactions, demonstrated that the anesthetic action of a local anesthetic solution is proportional to the amount of free anesthetic base that the solution contains, and that if the solution is made alkaline, this base is the more readily liberated. Clinical confirmation was reported by A. Laewen in September, 1910.[3]

A number of reports by other research workers followed, corroborating Dr. Gros' theories, but suggesting the use of various vehicles to make up the solutions, and obtaining similar results. All agreed that these alkaline anesthetic solutions must be freshly prepared just before use.[4]

If these theories, so convincingly advanced and demonstrated, are true, and we have every reason to feel assured they are, the manufacturers of the anesthetic solutions that we have been using have evidently been working at cross purposes, for the solutions that have been offered to us have had an acid reaction, i.e., a p_H lower than 7.0, some even as low as 4.5 or less, owing, in some instances, to the attempt to prevent the oxidation of the epinephrine in solution by the addition of other chemicals, a practice that has been most heartily condemned by Guido Fischer.[5]

A. J. Copeland and H. E. F. Notton,[6] also M. Trevan and E. Boock,[7] confirmed the findings of Dr. Gros, that neither the ionic base of the electrically dissociated salt, nor the molecules of the salt in the injected solution, induce anesthesia, but the lipoid soluble hydrolytically freed base, which, according to William Bayliss,[8] is adsorbed by the lipoid substances in the cell membrane. In an acid solution, this base is not readily available; and, on the injection of such a solution, anesthesia does not take place

1. De Takats, Geza: Preparation of Local Anesthetic Solutions, Bull. Am. Col. Surgeons, December, 1933.

2. Gros, Oscar: Ueber Narcotika und Lokalanäesthetika, Arch. f. Exper. Path., 62:63, 1910; 63:80, 1910; 67:126, 1912.

3. Laewen, A.: München. med. Wchnschr., 1910, p. 2044.

4. Sollman, Torald: Manual of Pharmacology and Its Application to Therapeutics and Toxicology, Ed. 3, Philadelphia: W. B. Saunders Co., 1926.

5. Fischer, Guido: Preparation of Solutions for Local Anesthesia, Klin. Wchnschr., 7:1838 (Sept. 16) 1928.

6. Copeland, A. J., and Notton, H. E. F.: Borocaines, New Class of Local Anesthetics, Brit. M. J., 2:547 (Sept. 26) 1925.

7. Trevan, J. W., and Boock, E.: Relation of Hydrogen Ion Concentration to Action of Local Anesthetics, Brit. J. Exper. Path., 8:307 (Aug.) 1927.

8. Bayliss, William: Principles of General Physiology, 1927.

until the tissues have given up enough of their buffer salts to so far alkalinize the injected solution as to release the anesthetic base, that it may be taken up in the lipoid substances in the cell membrane and so obtain access to the interior of the cell.[8]

This withdrawal of buffer salts from the tissues to neutralize the acidity of, or alkalinize, the injected solution creates in the tissues themselves an abnormal condition. Their p_H has been lowered, and what have we but a local acidosis, that Fisher,[5] quoting von Schade and his coworkers, affirms to be synonymous with inflammation? ("Die Entzündung mit einer ausgesprochenen lokalen acidose einhergeht, und zwar die H-Hyperionie um so stärker, je akuter und schwerer die Entzündung war.")

It has been proved that the efficacy of procaine salts is related to the p_H of the solution, i.e., its hydrogen ion concentration. It is not necessary for dentists to read through a scientific treatise on hydrogen ion control to understand and appreciate the value of the theories involved. It is sufficient to say that most chemical compounds partially dissociate into ions (hydrogen and hydroxyl) when placed in aqueous solution, and that the term "hydrogen ion concentration" means the weight (expressed in grams) of the hydrogen in ionic form present in each 1,000 c.c. of solution. The extent of this dissociation depends on the nature of the compound, the nature of the solvent, temperature, dilution, etc., and the predominance of the hydrogen ions over the hydroxyl ions, or, vice versa, determines the acidity or alkalinity, expressed in terms of intensity, not volume, of that solution.[9]

1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
						NEUTRAL*							
(			acid			)	(		alkaline				)

*7.0 is the neutral point. Below 7.0 is on the acid side. Above 7.0 is on the alkaline side.

If, in addition to being acid, the injected solution is also hypotonic, i.e., with a salt content less than that of the blood and body fluids, as aptly expressed by G. de Takats,[1] "it hemolyzes the red cell, it ruptures the connective tissue and fat cells and induces tissue necrosis."

Arthur E. Smith, in 1920, under methods of applying local anesthesia says, "To achieve success in local anesthesia, the anesthetic solution must correspond to the physical laws of osmotic pressure and the physiologic laws which govern the function of tissue cells." Isotonic solutions were thought to prevent cell destruction, but, until the last few years, no consideration had been given to the hydrogen ion concentration of these solutions.

Because living cells are influenced[10] by the acidity due to ionic hydrogen and the alkalinity due to ionic hydroxyl rather than by the total hydrogen and hydroxyl, the control of that concentration which will insure the optimum reaction is a method of procedure that is worthy of serious consideration. But since the dissociated (ionic) hydrogen and hydroxyl comprises only a portion of

9. Clark, W. M.: Determination of Hydrogen Ions, Ed. 3, Baltimore: Williams & Wilkins, 1928.

10. Stitt, E. R.: Practical Bacteriology, Blood Work and Animal Parasitology, Philadelphia: P. Blakiston's Son & Co., 1927.

the total hydrogen and hydroxyl present in a solution, regular titration methods cannot be employed. Special methods[9] are necessary to determine its amount, and for this purpose the so-called p_H scale was devised. Degrees of acidity and alkalinity are expressed by this scale, but its units are called p_H values (not degrees, as in the Fahrenheit temperature scale).

On this scale, the p_H value 7.0 denotes neutrality; i.e., the number of hydrogen (acid) and hydroxyl (alkaline) ions are in exact proportion, as, for example, in pure distilled water. Values higher than 7.0, such as 7.4, 7.6 and 8.5, denote alkalinity. The degree of alkalinity increases as the numbers increase, each unit being ten times as alkaline as the one before. Values lower than 7.0, such as 6.5, 6.2, 5.0 and 4.5, denote acidity. The degree of acidity increases as the numbers decrease, each unit being ten times as acid as the preceding higher unit. For example, a solution having a p_H value of 9.0 is ten times as alkaline as one having a p_H value of 8.0; and a solution having a p_H value of 4.5, is 100 times as acid as one having a p_H value of 6.5.

In my practice, since the introduction of ampules and cartridges, the referred cases of infection have materially decreased because of the sterility of the solution used. The last two years, I have used, at different times, a manufactured solution with an advertised p_H of approximately 6.6. Although this solution has proved far superior to any manufactured procaine solution previously employed, it still leaves much to be desired, for the results obtained were not uniform and dependable. When testing the p_H of the solution, in an attempt to determine the cause of this inconsistency, I have found, on examination of 10 ampules in each 100 ampule box, that the p_H varies. On close examination, several rubber stoppers were found loose, and, in a number of cases, no anesthesia was procured. Five hundred ampules were bought and kept four months, and eighty-eight were returned very badly discolored. Other widely advertised, manufactured solutions were tested and found to have a p_H of 4.5 and less.

If a highly acid solution is used, before the solution is neutralized, there is a dilatation of the peripheral blood vessels, allowing procaine and epinephrine to enter the circulation. When this takes place, undesirable symptoms may develop. When such symptoms develop, they may be due to the procaine or the vasoconstricting agent or to the hypersusceptibility of the patient.

The alkaline reserve of the body plays an important part in the degree of after-pain when acid solutions are used. This is probably another reason that, in the past, when using the same solutions and technic, we have experienced difficulty in some cases and not in others. In the last few years, we have all heard great claims for procaine borate. Anesthetic efficiency is usually not confined solely to the onset of anesthesia: duration of anesthesia should also be included. Procaine borate seems to lack this property of duration. I have not found procaine borate to be any better than procaine hydrochloride; in fact, in some instances, it is not nearly so effective. I believe that procaine hydrochloride produces anesthesia as rapidly as the borate salt, provided the procaine hydrochloride is buffered to the p_H of the borate salt. This alkalination of the hydrochloride solution insures its hydrolytic dissociation instead of electrical dissociation,[6] by means of which the base is liberated. And this, as noted in the foregoing, is the factor on which the effective action of a local anesthetic depends.

The use of 1 gm. of sodium carbonate per liter of distilled water has been ad-

vocated as a very satisfactory vehicle for the procaine hydrochloride, and the assertion made that after 2 per cent procaine hydrochloride and the usual amount of epinephrine are added to this vehicle, the resulting solution will have a p_H of about 7.8. By the method employed, the desired amount of vehicle was placed in individual test tubes, which were then stoppered with cotton, placed in a suitable rack and sterilized in an autoclave. As needed, the requisite number of procaine-epinephrine tablets were added to the contents of a test tube to make the percentage solution desired. When dissolved, the solution was ready for immediate use.

But such a procedure, while a decided step in the right direction, does not meet our requisites. In the first place, such a solution would be decidedly hypotonic; in the second place, the p_H would be indefinite and variable, the contributing factors being the form of sodium carbonate used, i.e., the monohydrated, the anhydrous or the C.P. (chemically pure) crystals; the difference in chemicals as made by the different manufacturers, or even in different lots by the same manufacturer; the age of the distilled water employed as the solvent,[11] and the exactness with which the manufacturing procedure is performed. It requires so little to make a wide variation in the intensity of a solution. Again, no assurance would be had of the actual anesthetic strength of the solution, for the efficacy of the procaine-epinephrine in tablet form decreases with age.[5] Furthermore, what assurance would be had as to the sterility of the finished solution? The tablets might have been contaminated by exposure or handling; and if we should attempt to sterilize the finished solution by the application of heat,[1] the activity of both the procaine and the epinephrine would be decreased.

We are striving for a solution which, when injected, will not cause after-pain, swelling, delayed healing or a local necrosis. This ideal solution should produce rapid and profound anesthesia, without toxicity. Theoretically, the ideal solution should have a p_H as near that of the living cell as possible. From reliable research, we know that acid solutions cause cytolysis, and that the destruction of cells will go on until the acidity is neutralized. But the determination of the p_H value of the solution to be injected is impossible without very elaborate equipment, and the time consumed in determining this value would be unreasonable. It is not possible to calculate in advance the p_H of a solution of procaine hydrochloride when dissolved in distilled water. The p_H of distilled water varies between 5.32 and 6.40, depending on the way it is prepared, the way it is stored and the amount of exposure it has had to air when opened for use. The p_H may be as high as 6.8 if the water has been freshly boiled in a glass flask that is not alkali free, and protected from the air so that it cannot reabsorb carbon dioxide. On exposure to air, the amount of carbon dioxide absorbed will gradually reach an equilibrium and the resulting p_H may be as low as 5.32.[11] If, to this water, the procaine hydrochloride and sufficient sodium chloride are added to make the solution isotonic, other changes in p_H will take place, the extent of which can be ascertained only by careful testing, and uniformity with a standard p_H can be obtained only by careful adjusting and further testing.

On sterilization by means of heat, whether in an autoclave, on a water bath

11. Williams, J. R.: Hydrogen Ion Concentration Studies on Distilled Water, Physiologic Sodium Chlorid, Glucose and Other Solutions Used for Intravenous Medication, J.A.M.A., 78:1024 (April 8) 1922.

or by boiling on the open flame, other changes take place, not only in p_H, but also in the activity of the procaine. The effect of this heat so diminishes the anesthetic properties of the procaine that, as Dr. de Takats affirmed in a recent paper,[1] "It is no exaggeration to state that few surgeons are really using an active novocaine solution and anesthesia must be obtained by over-infiltration of the tissues." Sterilization by the addition of other chemicals has been heartily condemned; consequently, the method that suggests itself is that of filtration by means of a Chamberlain or Berkfeld filter. But this method would be absolutely impractical in the dental office, or even in most hospital surgeries.

In the average dental office, where a local anesthetic is injected once or a dozen times a day, and where time consumed in preparing a solution is a factor, some method should be devised whereby a sterile, isotonic solution of procaine, with a standard p_H value, could be utilized without the need of expensive equipment and the encroachment on valuable time because of the need of detailed preparation.

I have given this matter serious thought and study and feel justified in advancing the following as a logical hypothesis: If, to a sterile ampule containing the requisite amount of dry sterile crystals of procaine hydrochloride and stoppered by means of a latex stopper with penetrable diaphragm, there should be added, by means of a sterile hypodermic syringe and needle, 5 c.c. of a sterile, buffered, isotonic solution the p_H value of which approximates that of the body fluids; i.e., sodium chloride—A. R., 7.0 gm.; secondary sodium phosphate—A.R. (Na_2HPO_4—Sorenson), 1.7 gm.; primary potassium phosphate—A.R. (KH_2PO_4—Sorenson), 0.2 gm.; double distilled water q.s., 1,000.0 c.c., that has been withdrawn from a similar ampule, and the vial should then be gently rotated for a few moments until solution has been effected, there would be ready for immediate use 5 c.c. of a sterile buffered isotonic 2 per cent procaine hydrochloride solution, with a p_H value of 7.3-7.6. In like manner, in cases in which it is not contraindicated, 1 minim of epinephrine solution (1:1,000) should be added to the vial containing the 5 c.c. of the procaine solution.

This procedure had its origin in conjecture and theory, but the practical application of the theory involved and the gratifying results obtained with solutions so prepared in my own office have convinced me of its soundness. In its development, I have used only the natural epinephrine (i.e., the laevogyrate), because of its smoothness and uniformity in action. But it must be borne in mind that the laevogyrate epinephrine possesses vasoconstrictive action that is more than double that of the racemic (synthetic) product[12]; that the toxicity of the procaine is in proportion to the concentration, the amount injected and the rate of absorption; that the toxicity of the procaine is not enhanced by the addition of small amounts of epinephrine (in fact, their actions are synergistic),[4] and that the vasoconstrictive action of the epinephrine confines the procaine to a restricted area and controls the rate of absorption. Consequently, the activity of the epinephrine to be used must be assured, and the exact amount to use must be given careful consideration. Unlike cocaine, procaine does not have vasoconstrictive properties. On the contrary, it dilates the blood vessels. Therefore, epinephrine solutions that have become discolored or have been sterilized by heat

12. Tiffeneau, C. D., in Martindale, William, and Westcott, W. W.: Extra Pharmacopoeia, Ed. 18, London: H. K. Lewis & Co.

after being added to the procaine solution, and the activity of which has been markedly decreased thereby, must not be used. By this decrease in activity, I mean the lessening of the vasoconstrictive power, which, in turn, permits a too rapid absorption of the procaine, with attendant toxic symptoms.

I have found that 2 minims of epinephrine-chloride solution (1:1,000) to 10 c.c. of this buffered procaine solution is sufficient for the average case. The onset of anesthesia is in evidence in less than one minute, with a profound anesthesia in less than four minutes that endures for the greater part of an hour.

The real value of this method of application lies in the fact that my patients do not suffer after-pain, no edema appears and healing is spontaneous, a "consummation devoutly to be wished" but never so satisfactorily attained with solutions previously used.

The numerous cases in which operation was performed with this solution and method of preparation have been most gratifying. Profound anesthesia is procured within three to four minutes and lasts for an hour. Patients who previously have had severe reactions and an unusual amount of pain after the removal of teeth complain of no after-pain when the solution advocated has been used. After the removal of a tooth, or a number of teeth, the normal circulation is quickly reestablished. Edema and inflammation are conspicuous by their absence. In removing cysts and tumors, and in difficult impactions and cases wherein an unusual amount of trauma was produced, I have been surprised at the healthy appearance of the tissues after the operative procedure.

A number of mandibular injections were made for the removal of teeth. On the right side, every known manufactured solution was used, and on the left the formula advocated in this paper. In no case did patients complain of so much after-pain on the left side as on the right. The healing was more rapid on the left side and there was no evidence of tissue necrosis with its attendant odor, which is generally present to a degree when acid solutions are used in the mouth. In patients with hypertension, 2 minims of epinephrine to 10 c.c. of the buffered procaine solution was employed and in no case was difficulty encountered.

Laboratory tests have been made by the Chemical Control Department of one of the eastern biological laboratories on the sterility of the procaine crystals and special buffer solution, packaged as herein noted, and also on the stability of the p_H of this solution when air is repeatedly forced into the vial so that the required amount of solution can be readily withdrawn, and the reports of F. R. Greenbaum[13] and E. S. Paisley[14] substantiate my findings.

13. Greenbaum, F. R.: Personal communication to the author.

14 Paisley, E. S.: Personal communication to the author.

POSTNATAL DEVELOPMENT AND CALCIFICATION OF THE ANTERIOR PERMANENT TEETH*

By RUDOLF KRONFELD, M.D., D.D.S., Chicago, Ill.

IN the introductory remarks to my report on the postnatal development of the first permanent molar, the history of this investigation and the kind of scientific material upon which it is based were given. Again, just as for the study of the first permanent molar, I have gone through these specimens with special consideration for the life history of the permanent anterior teeth. Some of the findings made by Dr. Logan and me concerning the onset of calcification of the permanent incisors and cuspids have been published in our report on postnatal tooth development.[1] The topography and development of the upper incisors and bicuspids during the first three years of life, with special emphasis on their surgical significance, have been reported by Logan.[2] In this paper, an attempt will be made to write a brief history of the upper and lower incisors and cuspids from birth to the time of their eruption.

*Read before the Section on Histology, Physiology, Pathology, Bacteriology and Chemistry (Research) at the Seventy-Sixth Annual Session of the American Dental Association, St. Paul, Minn., Aug. 8, 1934.

*From the Research Department of the Chicago College of Dental Surgery, Dental Department of Loyola University.

1. Logan, W. H. G., and Kronfeld, Rudolf: Development of Human Jaws and Surrounding Structures from Birth to Age of Fifteen Years, J.A.D.A., 20:379 (March) 1933.

2. Logan, W. H. G.: Histologic Study of Anatomic Structures Forming Oral Cavity, J.A.D.A., 22:3 (Jan.) 1935.

LITERATURE CONCERNING THE CALCIFICATION AND DEVELOPMENT OF THE PERMANENT ANTERIOR TEETH

It is not my intention to quote all dental authorities of the past and present century as to their statements concerning the onset of calcification of the permanent anterior teeth. With our present-day knowledge, we can for the most part divide the earlier authors into two groups: those who put the onset of calcification too early and those who put it too late.

Among the first, Magitot deserves special attention, because, in cooperation with Legros,[3] he compiled a table on calcification, which is still found in some of the most recent dental textbooks. In this original table, Magitot puts the onset of calcification of all permanent anterior teeth in the first month after birth. In another publication which appeared eight years later,[4] he modified these data somewhat by giving the third to the fourth month after birth for the cuspids.

With the exception of the data for the upper lateral incisor, these figures of Magitot are quite correct, especially those in his second table, of 1881. They come within a month or two of our recent histologic findings. It is interesting to note

3. Legros, Charles, and Magitot, Emile: Origine et Formation du Follicule Dentaire Chez les Mammifères, J. de l'anat. et de la physiol., September-October, 1873, p. 449.

4. Magitot, Emile: Études Cliniques Sur l'Erosion des Dents Considerée Comme Signe Rétrospectif de l'Éclampsie Infantile, Gaz. d. Hôpitaux, 54:891, 1881.

that Magitot recognized clearly the importance of enamel hypoplasia in ascertaining the chronology of tooth development.

Shortly after the first publications of Magitot in France, two American authors published tables of calcification, which have been used ever since as standard ones. These two investigators were G. V. Black and C. N. Peirce. In Black's table of 1883,[5] the calcification of the central incisor, lateral incisor and cuspid is indicated as taking place at the ages of 1 year, 2 years and 3 years, respectively. beginning to calcify at 1 year, the lateral incisor between 1 and 2 years, and the cuspid between 2 and 3 years.

Neither Black nor Peirce gives any definite information about the scientific material used for his studies. It does not seem likely that they actually examined many human jaws; otherwise, it would be hard to understand how they could have overlooked, for instance, the presence of the rather large calcified portions of the permanent cuspids at the age of 1 year, which at this age can easily be seen, even in a gross anatomic specimen.

Formation of the Permanent Incisors and Cuspids

Tooth	Differentiation of Germ into Enamel Organ and Pulp	Beginning of Dentin and Enamel Formation	First Evidence of Enamel Maturation	Complete Formation and Calcification of Enamel
Upper central incisor	7 to 8 fetal months	3 to 4 months	1 year	4 to 5 years
Upper lateral incisor	7 to 8 months after birth	1 year	2 years	4 to 5 years
Upper cuspid	8 to 9 fetal months	4 to 5 months	1½ years	6 to 7 years
Lower central incisor	7 to 8 fetal months	3 to 4 months	1 year	4 to 5 years
Lower lateral incisor	7 to 8 fetal months	3 to 4 months	1 year	4 to 5 years
Lower cuspid	8 to 9 fetal months	4 to 5 months	1½ years	6 to 7 years

The same figures are found in another diagrammatic representation of tooth development which appears in Black's "Text-Book of Operative Dentistry."

Peirce published in 1884[6] the famous diagram showing tooth development which has found its way into the scientific literature of the entire world. In this diagram, the central incisor is shown as

In 1891, two outstanding contributions to the study of tooth development appeared in German literature: the work of Röse[7] and of Zuckerkandl.[8] Both of these authors gave an exact account of the material used for their study and of the technic employed. Röse worked mostly with histologic sections and with dissections. Zuckerkandl studied a large col-

5. Black, G. V.: Table of Lines of Contemporaneous Calcification of Teeth, Tr. Illinois D. Soc., 1883.

6. Peirce, C. N.: Calcification and Decalcification of Teeth, D. Cosmos, 26:449 (Aug.) 1884.

7. Röse, Carl: Über die Entwicklung der Zähne des Menschen, Arch. f. Mikroskop. Anat., 38:447, 1891.

8. Zuckerkandl, E.: Makroskopische Anatomie, in: Scheff's Handbuch der Zahnheilkunde, 1:1-208, 1891.

lection of human skulls from which he removed the tooth germs or exposed them by removing some of the overlying bone.

Röse found no calcification of the permanent anterior teeth at the age of 4 months. From the dimensions of the deciduous teeth that were measured in this four months' specimen, it is evident that the child was considerably behind in its physical development. The next stage he examined was the mandible of a child of six months, in which he found calcified caps, 3, 2.5 and 1 mm. high on the permanent central incisor, lateral incisor and cuspid, respectively. At 10 months, the dimensions of the calcified portions of the anterior teeth were from 5 to 7 mm. high. Röse carried on this investigation to the age of 3¼ years, giving for each stage the

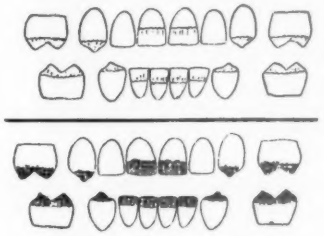

Fig. 1.—Reproduction of Figures 2 and 3 of J. Berten's paper on enamel hypoplasia (1895), showing intact upper lateral incisors.

height of the calcified portion of each tooth.

In Zuckerkandl's contribution to Scheff's "Handbuch" (1891), the following findings about the development of the permanent anterior teeth were reported: At 3 months, no calcification was found. At from 5 to 6 months, there were calcified caps on the central incisor and the cuspid in the upper jaw, but none on the lateral incisor. Between 7 and 9 months, Zuckerkandl observed in the upper jaw calcification of one third of the crown of the central incisor and of the tip of the cuspid, but no calcification on the lateral incisor. In the lower jaw, at the same age, the incisal one third of both central and lateral incisor was calcified, as well as the tip of the cuspid.

The latter observations of Zuckerkandl are in full accord with our own observations, and I should like to emphasize the fact that Zuckerkandl was the first to notice the striking difference in the relative development of the upper and lower permanent lateral incisors during the first year of life. After describing the absence of calcification in the upper lateral incisor between 6 and 9 months, during which time the central incisor and the cuspid show considerable calcification, Zuckerkandl says: "Unfortunately I possess only two preparations from the sixth

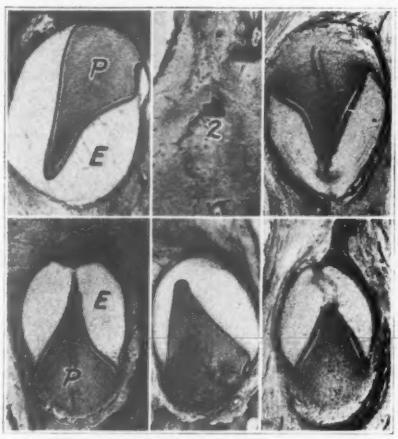

Fig. 2.—Upper and lower permanent incisors and cuspids of new-born child. Above, left, upper central incisor. *E*, enamel organ; *P*, pulp. (Actual dimensions, 1.5 by 1 mm.) Above, center, upper lateral incisor. Epithelial bud (*2*), 0.2 mm. actual size. Above, right, upper cuspid. (Actual dimensions: 1 by 1 mm.) Below, left, lower central incisor. *E*, enamel organ; *P*, pulp. (Actual dimensions, 0.8 by 1 mm.) Below, center, lower lateral incisor. Below, right, lower cuspid. (×12.)

to the seventh month, so that in regard to the upper permanent lateral incisor I cannot say whether this is an anomaly or whether the calcification of this tooth normally begins at a later period."

The first definite conclusion from the observation of enamel hypoplasia was reached by O. Zsigmondy[9] and was published in a paper he read at the World's Columbian Dental Congress in Chicago

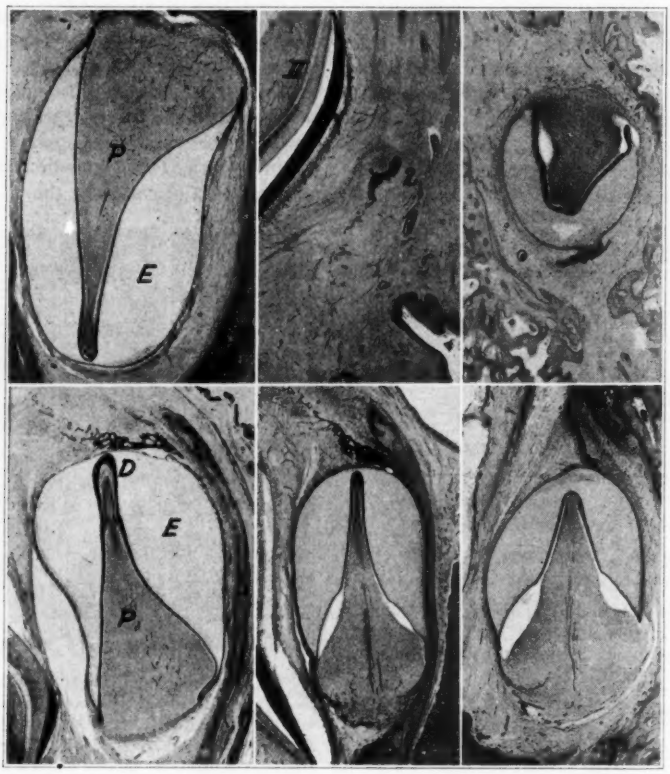

Fig. 3.—Upper and lower permanent anterior teeth at 2 months. Above, left, upper central incisor. *E*, enamel organ; *P*, pulp. (Actual dimensions of enamel organ, 4.5 by 2.2 by 6 mm.) Above, center, upper lateral incisor. Epithelial bud (*2*), 0.3 mm. actual size. *DL*, dental lamina; *II*, enamel, dentin and pulp of deciduous lateral incisor. Above, right, upper cuspid. Below, left, lower central incisor. *E*, enamel organ; *P*, pulp; *D*, cap of enamel and dentin. Below, center, lower lateral incisor. Below, right, lower cuspid. (×12.)

The relatively late onset of calcification of the upper lateral incisor is most strikingly shown in the distribution of enamel hypoplasia of the anterior teeth.

9. Zsigmondy, Otto: Beiträge zur Kenntnis der Entstehungsursache der Hypoplastischen Emaildefecte, Tr. World's Columbian D. Cong., 1:48, 1894.

in 1893. To quote Zsigmondy: "In the upper jaw the order of calcification is (1) central incisor, (2) cuspid and (3) lateral incisor; in the lower jaw (1) central incisor, (2) lateral incisor and (3) cuspid."

An extensive investigation of enamel hypoplasia was reported in 1895 by Berten.[10] His figures 2 and 3 are reproduced here (Fig. 1). In the examination of specimens of jaws at the ages of from 5 to 6 months and at 9 months, he found calcification present in the upper central incisors and cuspids and the lower incisors and cuspids, but not in the upper lateral incisors. At 12 months, Berten found the calcified portion of the upper lateral incisor 2 mm. high, the corresponding lower lateral incisor being 5 mm. high. He summarized his findings about the calci-

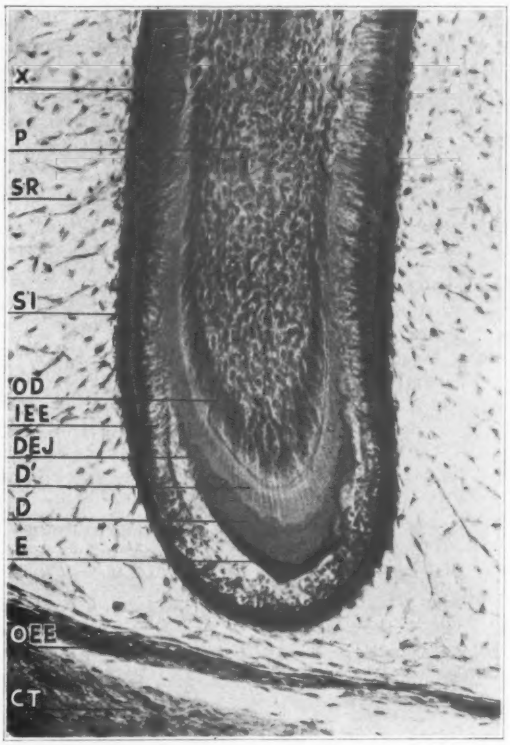

Fig. 4.—Higher magnification of upper central incisor shown in Figure 3 (aged 2 months). Earliest stage of formation of enamel and dentin. *CT*, connective tissue of tooth follicle; *OEE*, outer enamel epithelium; *SR*, stellate reticulum; *SI*, stratum intermedium; *IEE*, inner enamel epithelium (ameloblasts); *E*, enamel; *DEJ*, scalloped dentino-enamel junction; *x*, prominent groups of ameloblasts; *D*, calcified dentin; *D'*, uncalcified dentin (dentinoid); *OD*, odontoblasts; *P*, pulp. (Actual height of calcified portion, 0.3 mm.) (×160.)

10. Berten, J.: Hypoplasie des Schmelzes, D. Monat. f. Zahnheilk., 13:425, 483, 533, 587, 1895.

fication of the permanent teeth in a diagram, in which he indicated the onset of calcification of the upper lateral incisor as taking place one fourth of a year later than that of the upper central incisor and upper cuspid. This discrepancy between his actual anatomic findings and his graphic representation of them can perhaps be explained by his hesitancy to accept a rather surprising observation as a fact. He himself revealed this uncertainty in the following statement (referring to the observation that at the age of 5 or 6 months, the upper lateral incisors are not yet calcified; whereas, all other anterior teeth show beginning calcification):

> Because of this common observation Zuckerkandl assumes that the upper and lower cuspids always begin to calcify earlier than the upper lateral incisors. I cannot agree with this opinion because the total number of cases observed is still too small. I always consider this occurrence a deviation from the normal sequence of calcification which may be explained in part by the not uncommon, complete absence of the upper lateral incisors, and in part by the marked prominence of the tips of the cuspids above the level of the upper lateral incisor.

During the last years of the past century, Broomell[11] dissected a large number of jaws of fetuses and infants. He did not materially modify the data for the calcification of the anterior teeth as laid down by Black and Peirce. For the upper and lower central and lateral incisors, he states that calcification begins during the first year of life; for the cuspids, during the third year. This error of putting the onset of calcification of the cuspid into such a late period is also noticeable in all later writings or tables based upon the authority of Black or Peirce, rather than upon new investigations.

Although the roentgenographic studies of tooth calcification which were made in the first decade of the twentieth century gave some very interesting information concerning the development of the permanent molars, they did not contribute equally to the knowledge of the early development of the anterior permanent teeth.[12] This is largely due to the difficulty of demonstrating the early stages of calcification of the permanent teeth when the shadows of the deciduous predecessors project over them. No additional histologic or anatomic study of postnatal tooth development was reported after this until 1929. Most American writers followed the table of Magitot, Black or Peirce. In German dental literature, we find either Peirce's table, introduced by Preiswerk, or data based upon the work of Röse (Eidmann, Meyer), with minor modifications. Two Viennese authors, Sicher and Tandler, worked out very elaborate diagrams on postnatal tooth development, but their data for the onset of calcification of the permanent dentition were based upon an incorrect source, namely, Brady's tables.[12]

In England, Colyer[13] compiled a table of calcification of his own, which was based upon actual observation of skulls and upon the roentgenographic study of Symington and Rankin. Although the data are not given in great detail, they bear out the simultaneous onset of calcification of central incisors, lower lateral incisors and cuspids, and the relatively delayed development of the upper lateral incisors.

In 1929, Dr. Logan and I began a sys-

11. Broomell, I. N.: Anatomy and Histology of Mouth and Teeth, Philadelphia: P. Blakiston's Son and Co., 1898.

12. Kronfeld, Rudolf: First Permanent Molar. Condition at Birth and Postnatal Development, J.A.D.A., 22:1131 (July) 1935.

13. Colyer, J. F.: Dental Surgery and Pathology, Ed. 4, London: Longmans, Green and Co., 1919.

tematic histologic investigation of postnatal tooth development, using serial sections from more than thirty human jaws, ranging in age from birth to adolescence. Since this work was started, a few publications have appeared dealing with postnatal tooth development and with enamel hypoplasia. The extensive statistical study of Calteux[14] on enamel hypoplasia (1934) deserves special attention. It will be considered in detail in connection with the relative distribution of the hypoplastic defects on the anterior teeth.

FINDINGS

The condition of the permanent anterior teeth for the following age periods will be briefly described: new-born, 2 months, 6 months, 9 months, 1 year, 1½ years, 2 years, 3 years and 4½ years. Then the history of each one of these teeth during the first years of life will be summarized in a table.

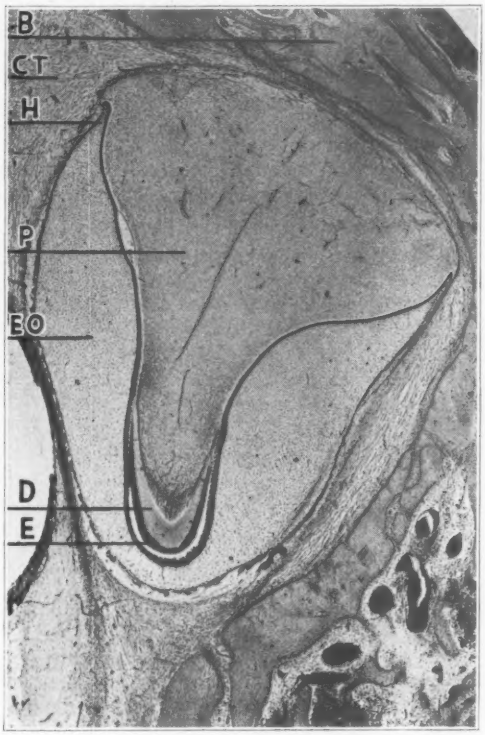

Fig. 5.—Upper permanent cuspid at 6 months. *EO*, enamel organ; *H*, Hertwig's sheath; *E*, enamel; *D*, dentin; *P*, pulp; *CT*, connective tissue (tooth follicle); *B*, alveolar bone. (Actual dimensions of enamel organ, 3.5 by 3 mm.; height of calcified cap, 1 mm.) (×18.)

The New-Born (Fig. 2).—Figure 2

14. Calteux, J. P.: Die Schmelzhypoplasie, Leipzig: Thieme, 1934.

shows photomicrographs of the upper and lower central incisor, lateral incisor and cuspid of a term fetus. The magnification of all six germs is identical, namely 12 diameters. Their actual size can therefore be easily estimated by dividing the size by 12. Thus, it becomes evident that the size of the germs of the upper central incisors and cuspids and the lower incisors and cuspids varies from 1.2 mm. (central incisor) to 1 mm. (cuspid). These teeth are in the stage of development in which the enamel organ (*E*) is bell-shaped and surrounds a clearly outlined dental papilla (*P*).

Fig. 6.—Upper and lower permanent anterior teeth at 9 months. Severe enamel hypoplasia. Above, left, upper central incisor. *Cy*, cystic degeneration of enamel epithelium. Above, center, upper lateral incisor. *E*, enamel organ; *P*, pulp. No calcification; enamel organ histologically normal. Above, right, upper cuspid; same pathologic changes as central incisor. Below, lower central incisor, lateral incisor and cuspid; extensive pathologic changes in enamel organ; cyst formation *(Cy)* and irregular deposition of enamel. (×10.)

The one tooth whose development is

not so far advanced is the upper lateral incisor. At the time of birth, this tooth is a small, solid epithelial bud of less than 0.2 mm. in its greatest diameter. On its labial and upper side, there is a shallow depression opposite a beginning condensation of the mesenchyme. This is the first indication of the formation of a dental papilla.

As to the germs of the permanent posterior teeth, little need be added. The bicuspids at this time are nothing more than a terminal swelling of the dental lamina, located on the linguo-occlusal sion of the dental lamina distad from the first permanent molar.

Two Months (Fig. 13).—In comparing Figure 3 with Figure 2 (new-born), one is aware of the extent and number of growth changes that take place in the permanent germs during the first few months of postnatal life. The illustrations are taken with the same magnification, and although I am fully aware of the fact that different infants have different body dimensions, in the fourteen specimens with ages between birth and 1 year there is a consistent and proportion-

Fig. 7.—Upper first permanent molar of jaw, anterior teeth of which were shown in Figure 6 (aged 9 months). *Cy*, cystic degeneration of enamel organ; *E*, enamel; *D*, dentin; *P*, pulp. (×10.)

side of the germ of the corresponding deciduous molars.[1] The first permanent molar of the new-born is a very large germ, consisting of the enamel organ and pulp, and occasionally showing beginning formation of enamel and dentin at the tip of the buccomesial pulp horn.[12] Of the second permanent molar, nothing is present except the beginning of an extenate increase in the size of the permanent tooth germ with advancing age that warrants this comparison.

The upper central incisor is considerably larger in all dimensions. Its enamel organ is 4.5 mm. high and 2.2 mm. thick. Its mesiodistal width, measured in cross-sections through the germ, is 6 mm., or about two-thirds that of the average

crown of a fully formed upper central incisor. At the incisal edge of the crown, the very earliest formation of enamel and dentin may be recognized. In the second 2 months old jaw which was examined, there was no calcification of the central incisor. The 3 months and 5 months old specimens showed an equal amount of dentin and enamel in the upper central incisor, which is slightly more than the 2 months old jaw illustrated in Figures 3 and 4.

As far as I know, no specimen of the very earliest stage of hard tissue formation of a permanent anterior tooth has ever been illustrated in the literature. Therefore, a higher magnification of the

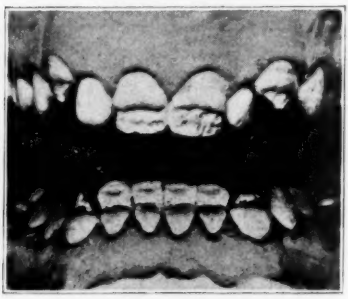

Fig. 8.—Reproduction from Calteux, "Enamel Hypoplasia" (1934). Hypoplastic upper central incisors, cuspids and first molars and lower incisors, cuspids and first molars; intact upper lateral incisors.

upper central incisor in Figure 3 is shown in Figure 4. In this photomicrograph, the following embryonal layers of the tooth germ can be distinguished. The surface of the enamel organ is formed by the outer enamel epithelium (*OEE*), consisting of two or three layers of flat epithelial cells. The bulk of the enamel organ consists of the enamel pulp or stellate reticulum (*SR*). Toward the inner enamel epithelium, the stratum intermedium (*SI*) may be recognized as a denser layer of cells. The inner enamel epithelium (*IEE*) has already assumed the characteristic tall cylindrical shape of ameloblasts (ganoblasts).

Inside the ameloblasts, we find a cap of hard tissue about 0.3 mm. high and at its tip 0.1 mm. thick. Most of it is dentin. Only at the tip is there a very thin layer of enamel (*E*), which stains a deep brownish purple with hematoxylin and eosin and which, therefore, appears black in the photograph. The boundary between the enamel and the underlying dentin (*D*) has the typical scalloped appearance. In the area where only dentin is present (*X*), the ameloblasts are arranged in groups which project pulpward with a wavy contour. Thus, the dentin is deposited upon an uneven, embossed surface. (Orban,[15] Tylman.[16])

In the dentin, two layers of about the same thickness may be distinguished: an outer layer, stained bluish and representing the calcified dentin (*D*) and an inner light pink (eosinophilic) layer of uncalcified predentin or dentinoid (*D'*). The pulp (*P*) consists of large, round connective tissue cells with very little intercellular substance. The peripheral pulp cells have become differentiated into tall cylindric odontoblasts (*OD*).

The lower central incisor is in a stage of development very similar to that of the upper incisor; in fact, the hard tissue formation is even somewhat ahead of that in the corresponding upper tooth. This is not a regular occurrence. On the contrary, during the first years of life, there is a marked preponderance of development in the upper teeth as compared to the lower ones. The germ of the lower lateral incisor is slightly smaller than that

15. Orban, Balint: Dental Histology and Embryology Ed. 2, Philadelphia: P. Blakiston's Son & Co., Inc., 1929.

16. Tylman, S. D.: Dento-Enamel Junction, J. D. Res., 8:615 (Dec.) 1928.

of the lower central. Calcification has not yet started. The upper and lower cuspid germs are round, between 2 and 2.5 mm. in diameter, and without calcification.

The upper lateral incisor is the same as that in the new-born. It is still a club-shaped, solid terminal swelling of the dental lamina with a slight indentation on the upper side, corresponding in position to the future dental papilla. The size of the lateral incisor bud is about 0.3 mm.

Six Months.—The deciduous and permanent dentitions at six months have already been described and illustrated in the article of Logan and Kronfeld.[17] It will, therefore, be sufficient to give a brief description of the average permanent anterior teeth at this age.

Calcification has definitely begun in the upper central incisors and cuspids and the lower incisors and cuspids. The cap of enamel and dentin in all of these teeth is of almost uniform height, about 1 to 1.5 mm. Figure 5 shows the germ of the permanent upper cuspid. It consists of a rounded enamel organ, a large dental pulp and a cap of enamel and dentin 1 mm. in height. The enamel is about 0.04 mm. thick, the dentin about 0.2 mm.

The epithelial bud for the lateral incisor is about the same shape as in the specimen of 2 months. Its greatest diameter is about 0.3 mm.

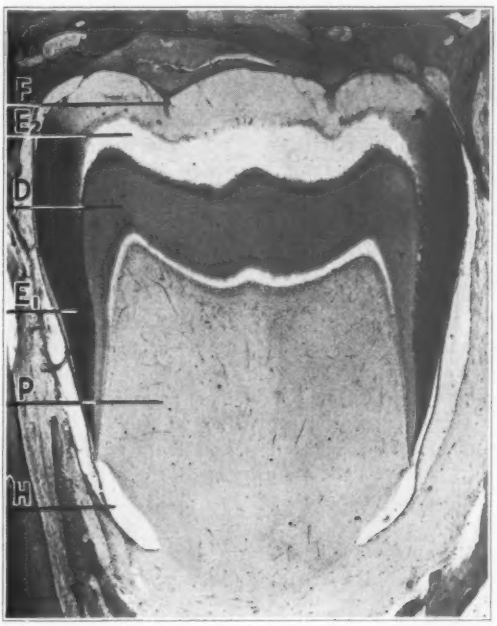

Fig. 9.—Mesiodistal section through lower central incisor at 1 year. E_1, recently formed enamel which is acid-fast; E_2, older enamel at incisal edge, partly or entirely dissolved by the acid; *F*, fissures between incisal tubercles; *D*, dentin; *P*, pulp; *H*, Hertwig's sheath. (×12.)

17. Footnote 1, Figs. 13, 14, 15, 17, 18, 19, 21, 22.

Nine Months (Figs. 6-7).—The jaws of the 9 months old child are of particular interest. At the time of death, the clinical diagnosis was rickets. Otherwise, no case history is available. The tooth germs show severe pathologic changes of the kind that clinically and in experimental animals is characteristic of enamel hypoplasia. These changes consist of interrupted and irregular enamel formation. In some portions of the crown, the enamel is rather thick. In closely adjacent areas, it is entirely missing. The inner enamel epithelium is detached from the forming enamel by the accumulation of large quantities of fluid. Some of these cysts in the enamel organ, especially in the upper molar, measure more than 3 mm. in their greatest diameter. (Fig. 7.)

The height of the calcified portion of the upper central incisors and the lower incisors is 4 mm., that of the cuspids, 3 mm. Attention should be called to this difference between the incisor and the cuspid: with advancing age, the cuspid development slows down; at the age of 18 months, for instance, the calcified portion of the upper central incisor is 7.5 mm. high, of the upper cuspid, 4.5 mm. Both central incisors and cuspids begin to calcify during the first half year of postnatal life, but because of their much earlier eruption, the incisors develop more rapidly.

The upper lateral incisor of the 9 months old jaw consists of a round enamel organ and pulp. The germ is 2.5 mm. in diameter, and without any calcification. The epithelial as well as the mesodermal structures of this germ are histologically normal, without any of the disturbances or abnormalities visible in the germs of the other anterior teeth.

Figure 7 shows an upper first permanent molar with severe rachitic changes in the enamel organ. The enamel epithelium is separated from the enamel surface by the accumulation of large quantities of fluid. In these areas of cystic degeneration of the enamel organ, the enamel formation has evidently ceased entirely. The dentin and the pulp are microscopically fairly normal. Only a slight disturbance of dentin calcification can be noticed. It is obvious that even if the enamel organ of this tooth were later on to undergo some reparative or regenerative changes, the crown would still be markedly hypoplastic.

The study of the jaw of this 9 months old rachitic child brings up two very important questions. One is the exact time of calcification of the upper lateral incisor, and the other the probable distribution of enamel hypoplasia on the permanent teeth had this child lived.

As to the onset of calcification, an upper lateral incisor of a 1 year old child which showed a tiny cap of enamel and dentin has already been shown by Logan.[2] Recently, through the courtesy of Paul Boyle, of the Harvard Medical School, I was able to examine sections through an upper lateral incisor of a child that had died at the age of exactly 11 months. This tooth germ showed just the beginning of the formation of enamel and dentin. This puts the onset of calcification of the upper lateral incisor fairly close to 1 year. Clinically (roentgenographically) or in gross anatomic sections, one cannot expect to find calcification of this tooth before the age of 15 or 18 months.

The other question is that of the relative distribution of hypoplastic enamel among the anterior teeth. It has already been pointed out in the article of Logan and Kronfeld[1] and again by Logan[2] that the upper lateral incisors are frequently intact when all the other anterior teeth have hypoplastic enamel defects. Recently (1934), there appeared a very interesting German monograph by Calteux[14] (Luxemburg) entitled "Enamel

Hypoplasia." Calteux reports on the incidence of enamel hypoplasia among more than 2,000 school children of Luxemburg. Of these, 188 showed enamel hypoplasia. The distribution of the defects among the various teeth was as follows: The first molars were affected in nearly 100 per cent of all cases of hypoplasia. The upper central incisors and the lower central and lateral incisors showed hypoplasia in about 90 per cent of all cases. The upper and lower cuspids were affected in 83 and 73 per cent of the cases, respectively. The upper lateral incisors were hypoplastic in only 45 per cent of all of the cases, or, in other words, just half as often as the upper central or the lower central and lateral incisors.

The clinical side of the problem of enamel hypoplasia is not within the scope of this paper. Magitot's work of 1881[4] is mentioned here because his clinical observations were closely related to his investigations of tooth development and had a definite influence on his data on calcification. Magitot reported the clinical histories of forty patients with enamel hypoplasia who had suffered from *convulsions et attaques éclamptiques* during infancy. He found that convulsions during the first year of life led to enamel hypoplasia in the anterior teeth and the first permanent molars. The upper lateral incisors were frequently intact. The bicuspids were never involved if the attacks occurred before the age of 18 months. Calteux made similar comparative investigations between the early clinical history and the distribution of enamel hypoplasia. As a rule, by the time the permanent teeth had erupted, it was found very difficult to secure exact case histories of early childhood. In numerous instances, a marked coincidence was found between the time of the illness and the intensity and distribution of hypoplastic defects.

Calteux is of the following opinion as to the etiology of enamel hypoplasia: The causative agent is a severe disturbance of the calcium metabolism with hypocalcemia. This is present in rickets and tetany, and also accompanies other diseases, such as measles, whoopingcough, pneumonia or severe gastro-intestinal disturbances. In Calteux's clinical material, the highest incidence of enamel hypoplasia was among children who, in addition to rickets, tetany or chronic gastro-intestinal disturbances, had suffered from acute infectious disease (measles, whoopingcough, scarlet fever, grippe).

A cast from the publication of Calteux is reproduced in Figure 8, showing the upper lateral incisors intact and the upper central incisors and cuspids and the lower incisors and cuspids markedly hypoplastic.

A study of the findings in the 9 months old specimen easily explains a clinical picture like the one in Figure 8. Suppose this child had recovered from its illness: The enamel formation in the upper central incisors, cuspids and first molars and the lower incisors, cuspids and first molars would undoubtedly be badly disturbed. Even if additional enamel were formed, it would be deposited upon an uneven, ragged surface and formation of an uneven hypoplastic crown would result. The upper lateral incisor, which at 9 months was not yet calcified and appears normal histologically, would develop and calcify normally, if there were no later interference.

In some instances, the upper lateral incisors also are clinically found to be hypoplastic. The explanation of this must, of necessity, be that some form of damage or metabolic disturbance (rickets, tetany) had taken place or had continued after the upper lateral incisor began to calcify. If there is a disturbance of the calcium metabolism during the first year

of life, the upper lateral incisors may escape injury. If the disturbance is during the second year, the lateral incisors are likely to be involved.

One Year.—At 1 year, the germs of the upper and lower central incisor and the lower lateral incisor were found to contain caps of enamel and dentin about 6 mm. in height. The enamel at the incisal edge is quite thick, more than 1 mm. It seems to have reached its ultimate thickness along the incisal edge, although it is still rather thin in the more cervical portions of the crown.

At this age, I have found the earliest evidence of maturation of the enamel in the permanent anterior teeth. The changes that take place in the enamel from its formation to maturity have been studied and discussed by von Ebner, Beust, Chase, Kitchin and others.[12] These changes were briefly reviewed in my paper on the first permanent molar. It is sufficient here to say that the youngest, most recently deposited enamel is acid-fast. It does not disappear during the process of decalcification of the specimen and stains a dark or brownish purple with hematoxylin and eosin. (Fig. 4.) Several months after its deposition, the physical properties of enamel change: it is dissolved by acid, and all that remains is a very delicate fibrous substance or nothing at all. Since the enamel formation in the incisors begins at the incisal edge and from here proceeds cervically, the first evidence of acid-soluble (mature) enamel is found at the incisal edge. This is illustrated in Figure 9, a mesiodistal section through a lower central incisor at 1 year. About two thirds of the total height of the crown is formed. Toward Hertwig's sheath, the enamel and dentin are still very thin. Along the mesial and distal side of the crown, the recently formed enamel has resisted decalcification. At the incisal edge, where the enamel formation had already stopped, most of the enamel has disappeared, particularly that of the deeper layers near the dentino-enamel junction, where the amelogenesis originally started. The three incisal tubercles of the incisor, with the separating minute fissures, can be clearly seen.

The upper lateral incisor at 1 year was illustrated in an article by Logan.[2] The height of the formed portion of dentin and enamel is 1.2 mm., its greatest thickness, 0.3 mm.

The upper and lower cuspids show caps of enamel and dentin 3.5 mm. in height and 2 mm. in the thickest part. All of the enamel of the cuspid is of the acid-fast, immature type.

Eighteen Months.—At 18 months, the formed enamel and dentin of the upper central and of the lower central and lateral incisor are about 7 mm. high. The enamel is mature and acid-soluble in the incisal one-half. In the upper and lower cuspid, the calcified portion is 4.5 mm. high. Only the very tip of the enamel is acid-soluble.

The upper lateral incisor shows a cap of dentin and enamel 3.5 mm. in height. All of the enamel is acid-fast. Attention should be called to the rapid growth of the upper lateral incisor from the age of 1 year on, especially in comparison to the cuspid development, which slows down. At 18 months, the development of the upper lateral incisor is almost equal to that of the cuspid. At 2 years, the two are in the same state of development. At 3 years, the upper lateral incisor is ahead of the cuspid.

Two Years.—At 2 years, the height of the crown of the upper central incisor is about 9 mm., that of all other anterior teeth, from 6.5 to 7 mm. (Obviously, these figures are of only relative value, depending upon whether the child from whom the measurements were taken had

large or small incisors. Since, according to G. V. Black's measurements, the length of the crown of the anterior permanent teeth varies from 2.5 to 4 mm., it must be assumed that proportionate individual variations may be found in the forming tooth germs.)

The stage of development of the enamel is in direct correlation with that of the individual tooth. In the upper and lower central incisors and the lower lateral incisors, only the cervical one fifth of the enamel is still immature. In the upper lateral incisor, the cervical one third of the enamel is immature, and in the cuspids, the cervical one-half.

Three Years.—At 3 years, the crown of the central incisor is nearly completed. Hertwig's sheath is located at the future cemento-enamel junction. Little immature enamel is present in the cervical portion of the crown. The lateral incisors are slightly less developed, and also show a little more immature enamel. Of the cuspid crown, the incisal two-thirds are present. The cervical one fourth of the enamel is still immature.

Four and One-Half Years.—In the jaws of a child of 4½ years, the crowns of the upper and lower central and lateral incisors are fully formed and the enamel entirely matured. All of the incisors have a 1 mm. long root. In the cuspids, the crown is almost completed, and there is very little immature enamel in the cervical portion of the crown.[2]

The accompanying table analyzes and summarizes these findings.

It will be noted that, in this table, the range of ages in column three (beginning of dentin and enamel formation) is somewhat more restricted and gives less leeway than that published in the article by Logan and Kronfeld.[1] This is due to the fact that many more histologic sections have been prepared and studied since the other article was written over two years ago, and this new material makes it possible to give more specific data than before.

As to the question of systemic disturbances, endocrines, and nutrition in relation to the teeth, the following considerations are of importance:

During the first year of life, disturbances or diseases which interfere with the normal calcification of the enamel are likely to affect the following permanent teeth: the upper central incisors, cuspids and first molars and the lower incisors, cuspids and first molars. If the disturbance continues throughout the second year, the upper lateral incisors will also be involved. During the third year, the enamel of the incisal portions of the anterior teeth is completed and becomes mature. Therefore, a disturbance starting at this age can affect only the middle and cervical thirds of the crowns. During the fourth year, all but the cervical portion of the enamel is matured. Therefore, only the cervical portion of the crown can be influenced by a systemic disturbance. Finally, after the age of 4 or 5 years, it is unlikely that any form of disease, deficiency or therapeutic measure can influence the enamel of the twelve anterior teeth, since by this time the crowns are fully formed and the enamel matured or nearly so.

SUMMARY

At birth, no calcification has taken place in the permanent anterior teeth.

At 2 or 3 months, enamel and dentin formation has begun in the upper central incisors and lower incisors. The upper and lower cuspids begin to calcify approximately one month later.

At 6 months, calcification is found in the following anterior permanent teeth: the upper central incisors and cuspids and the lower incisors and cuspids.

The upper lateral incisor begins to calcify at approximately 1 year.

The enamel at the tips of the upper central and lower incisors becomes mature (acid-soluble) at approximately 1 year; that of the cuspids at 1½ years, and that of the lateral incisors at 2 years.

After the fifth year, the enamel of the incisors is completely formed and matured; after the sixth year, that of the cuspids.

The distribution of enamel hypoplasia is an accurate record of the sequence of calcification and the relative degree of development of the various teeth.

SUMMARY OF DATA FOR THE OTHER PERMANENT TEETH

Corresponding data for the other permanent teeth, taken from the earlier publications of Logan and Kronfeld[18] on this subject are as follows:

First Permanent Molars.—Calcification begins at birth or shortly thereafter. Cusps begin to fuse at from 6 to 8 months. Enamel at the tips of cusps begins to mature at 1 year. The entire crown is fully formed and enamel matured at 3 years.

First Bicuspids.—Calcification begins at from 1½ to 2 years. Enamel at tips of cusps begins to mature at 3 years. The crown is fully formed and enamel matured at 6 years.

Second Bicuspids.—Calcification begins at from 2 to 2½ years. Enamel at the tips begins to mature at from 3½ to 4 years. The crown is fully formed and enamel matured at 7 years.

The upper bicuspids usually show a slightly more advanced state of development than the corresponding lower ones.

Second Permanent Molars.—Calcification begins at from 2½ to 3 years. Enamel at tips of cusps begins to mature at 4 years. The crown is fully formed at 7 years.

Third Permanent Molars.—Calcification begins between the ages of 7 and 10 years.

18. Footnotes 1, 2, 12.

ETHICS

By RALPH R. BYRNES, D.D.S., F.A.C.D., Atlanta, Ga.

IN this paper, I shall deal with ethics in the broadest sense, having in mind the ethical relationship between the general public and the dental profession, rather than consider in detail the ethical conduct of a dental practice. Ethics for the individual practitioner has been thoroughly defined in the Code of Ethics of the American Dental Association, which is quite generally known. Ethics and economics are so much akin that it is almost impossible to treat one without involving the other. Therefore, I shall also touch on certain general economic problems, endeavoring to determine the soundness or unsoundness of the ethical principles behind them.

The Encyclopedia Brittanica defines ethics as "the science of moral philosophy." It qualifies this definition by stating that, in the strict sense of the word, ethics cannot be considered a science, but should be regarded rather as a philosophy, since there can be no exact universal definition of ethics. The conception of ethics is too much influenced by geography, customs and periods of time.

For those among us who may be in

the habit of saying what is right and what is wrong, on the spur of the moment, it will be interesting to recall that philosophers and writers have been struggling with the problems of ethics for centuries. There is probably no subject more abstract than this, for the reason that our conceptions of right and wrong are largely abstractions. It is interesting also to recall that the word "ethics" is derived from a Greek word meaning "pertaining to character."

The study of ethics began with the Greeks and Romans. We may group ethics historically under three heads: 1. Greek and Graeco-Roman ethics. 2. Christianity and medieval ethics. 3. Modern ethics.

A more detailed outline of the history of ethics would include the following:

A. Greek and Græco-Roman Ethics
1. The Age of Sophistry
2. Pythagoras (582-500 B.C.)
3. Socrates (469-399 B.C.) and his school
4. Plato (427-347 B.C.)
5. Aristotle (384-322 B.C.)
6. Stoicism
7. Hedonism
8. Later Greek and Roman ethics
9. Neoplatonism

B. Christianity and Medieval Ethics
1. Christian and Jewish "Law of God"
2. Christian and Pagan inwardness
3. Distinctive particulars of Christian morality
4. Development of opinion in early Christianity (Augustine, Ambrose)
5. Medieval morality and moral philosophy
6. Thomas Aquinas (1226-1274)
7. Casuistry and Jesuitry
8. The Reformation and birth of modern thought

C. Modern Ethics
1. Gratian (?-1160)
2. Thomas Hobbes (1588-1679)
3. The Cambridge Moralists (Cudworth, More)
4. John Locke (1632-1704)
5. Clarke
6. Shaftesbury
7. Mandeville
8. Butler
9. Wollaston
10. Hutcheson
11. David Hume (1711-1776)
12. Adam Smith (1723-1790)
13. The Intuitional School (Price, Reed, Stewart, Whewell)
14. The Utilitarian School (Paley, Bentham, Mill)
15. Association and evolution
16. Free will
17. French influence on English ethics (Helvetius, Comte)
18. German influence on English ethics (Kant, Hegel)

D. Ethics since 1879

On first impression, the consideration of mental periods in the history of ethics may seem to be a rather dry undertaking. On the contrary, there should be no more interesting phase of man's development than his struggle through the centuries to perceive the truth and to determine what is good and what is evil in our relationships. Religion itself is but one of the developments of ethical thought. Orthodox religion considers right and wrong as inflexibles, rigidly defined in the scriptures. In a sense, it is man's effort to pass on to the Deity a problem that is apparently beyond his mental grasp.

In the preparation of this paper, I have found it an extremely interesting thing to trace the stream of ethical thought from its source to its modern aspect. Before taking up specifically the matter of ethics in dentistry, let us pause for a while on the various chapters in this fascinating history of human conduct, and mention a few of the personalities involved in the

outline that I have just given. They are not far removed from us spiritually and morally. Though we may not realize it, many of our actions are based upon the philosophic thought of the ancients. We are no farther from them in our modern ethics than we are distant from Farraday and Pasteur in modern science. Today, on every hand, we constantly hear such terms as "dental" ethics and "medical" ethics. There is no such thing as "dental" ethics. Ethics is ethics, regardless of what group of people may be applying, consciously or unconsciously, its principles. It would be better to say "ethics of dentistry" or "ethics of medicine."

In a general way, men regard their actions as "good," "bad," "right" and "wrong." It is the problem of ethics to determine just what is meant by these terms. Our estimate of character is based upon the number of a man's traits that fall in the "good" and "right" column, and the number that appear in the "bad" and "wrong" column. Of course, it is possible that a man may possess an outstanding, overwhelming virtue, and we are apt to like him in spite of his obvious faults.

Pythagoras (582-500 B.C.) was one of the very earliest thinkers to be concerned with phases of ethics. He thought of "good" in terms of unity and straightness. While I have found no proof of the assertion, I have little doubt that the modern slang terms "straight" and "crooked," as applied to personalities, have their origin in pythagorean philosophy. If a man knows the truth, he approaches it straightway. If he has some reason for concealing the truth, he falls into devious ways of expression, and we think of him as "beating around the bush." Indeed, many of our common expressions and social and economic attitudes can be traced back to Greek civilization. We owe that civilization an enormous debt, not only in general science but in literature and art as well. We are not always conscious of what we have derived from them. Greek thought is so diverse and comprehensive that it is ingrained in the very structure of our civilization.

The first pre-Socratic philosopher who may be considered as having organized his thought on ethics into a system is Democritus.

The Sophists were teachers who thrived at a time when moral philosophy was looked on as rather a forbidden territory in the realm of thought. Many of their teachings were fallacious, although some of the philosophers of this school contributed genuine and logical thought. Aristotle defined a sophist as "a man who makes money by sham wisdom." Sophistry has become known largely as specious reasoning. It is interesting to observe that our words "sophisticate" and "sophistication" are derived from the Sophists.

The towering figure of early philosophers was Socrates (469-399 B.C.). He was simple in all but his mental habits. He wore only one garment, and it is said of him that he walked barefoot in the snow, exclaiming, "How many things there are I do not need!" Socrates believed that virtue is knowledge, and that evil is ignorance. Four subsequent schools of thought grew up upon the ground work of Socratic philosophy: The Megarian, the Platonic, the Cynic, and the Cyrenaic. These schools differed rather sharply in certain things, but they all believed in common with Socrates that man's most important attribute is wisdom or knowledge and that the knowledge of good is of paramount importance.

Euclid's was the greatest mind in the Megarian school. He agreed that the knowledge of good was man's greatest obligation, but he did not think of it as

being ultimate. He thought of it as being bound up with the secret of the universe. Others of this school, less easy to please, thought of "good" as a known quality, and concerned themselves chiefly with the application of these concepts to human conduct.

Plato's (427-347 B.C.) real name was Aristocles. His thought was largely influenced by his great predecessor, Socrates. Plato said that individual things are the fleeting, perishable copies of the form of an idea. He also believed that the soul, in some previous state of existence, has beheld these ideas. Platonic friendship may be thought of as a mental comradeship; platonic love, as a spiritual comradeship or love without sexual desire. It seems that the longer civilization lasts, the more obsessed mankind becomes with the sex idea, and it is not surprising that "platonic friendship" has come to mean platonic love between the sexes, a kind of spiritual affinity which should be viewed with suspicion. Indeed, there are those who maintain that there cannot be such relation between man and woman without the intrusion of sex, at least before the age of 45 or thereabouts.

Aristotle, pupil of Plato, was born in 384 B.C., and died in 322 B.C. His father was a physician. He did not agree with the platonic doctrine of ideas. He may be regarded as the founder of the science of logic, and was largely responsible for the establishment of ethics as a philosophy. He dedicated his work on ethics to his son, Nichomáchus, which accounts for its being called "Nichomachean Ethics."

Stoicism, a school of thought founded by Zeno (340-260 B.C.), is opposed to Epicureanism or Hedonism, which holds that pleasure is the highest human good. Stoicism embraces the idea that good lies not in outward objects, but in the state of the soul itself. It glorifies the wisdom and restraint that enable a man to free himself from passion and desires that tend to disturb the ordinary life. (I think most of us are Hedonists, or pleasure-lovers, although we may, at times, strike an attitude of stoicism.) One would say, offhand, that stoic philosophy is the sounder of the two; but that is open for debate. Stoicism will help us to bear pain, but it will bring no ecstasy, except that of negation, and few of us are great enough to acquire a liking for that kind of ecstasy.

Neoplatonism, which originated about the third century, is based upon the teachings of Plato, but goes farther. The Neoplatonists thought it possible for man to attain a knowledge of "the Highest," conceding man the capacity for passing beyond the limits of empiric knowledge, into a knowledge of the absolute. The followers of this school rely heavily upon their intuition.

The next chronologic development in ethical thought brings us to Christianity and Medieval ethics, and the Christian and Jewish Law of God. The history of Christian morality includes the development of opinion in early Christianity, and such outstanding figures as Augustine and Ambrose. An interesting personality and thinker is Thomas Aquinas, a man of such reticence that his companions called him "dumb ox." But Thomas Aquinas was anything but "dumb," in the slang sense of the term. He taught in Paris, Rome, Bologna and Pisa. His influence persists to the present day in the Roman Church, and he is still considered an authority. He was canonized in 1323, and proclaimed a "Doctor of the Church" by Pius, in 1567.

About this time, a system of rules for the guidance of conscience developed, known as "Casuistry." The Casuists believed that each particular action is governed by some rule. Several schools de-

veloped from this basic conception: the Rigorists, the Probabiliorists, who taught that, in cases of doubt, man should always pursue the safer course, the Aequiprobabilists, who allowed liberty of action only when reasons were evenly balanced, and the Laxists, who believed that man is justified in acting, provided he has even a slight reason to conclude that he is right.

In 1534, Ignatius Loyola, founded the order of Jesuits, under the title of the Society of Jesus. Those adhering to the principles of this great Catholic order are known as Jesuits.

The next development was the Reformation, headed by the dynamic Martin Luther. This movement is believed to have started about 1517, when Luther challenged some of the papal teachings. This rebellion against the teachings of the Roman Catholic Church transcended the bounds of Protestantism, and was the activating cause of many changes in the political, social and intellectual thought of that time. In brief, the Protestantism of Luther was a rebellion against the supreme authority of the church, which had held continuous sway since the year 800. Like most great leaders, Luther was preceded by a number of lesser figures, who paved the way for his leadership. These included Erasmus (1466-1536), John Colet (1466-1519) and Sir Thomas More (1478-1535). John Calvin also received his inspiration from the teachings of these men.

The last great division in the chronology of ethics is called "modern ethics." Under "modern ethics," we find the names of a great number of important thinkers. In a paper of this kind, we can give only the barest account of a few of them and simply mention the names of the others. Thomas Hobbes (1588-1679) was an English philosopher and psychologist. He was considered a sensationalist, and many of his views were regarded as materialistic. Many regard his ethics as "hedonistic." Cudworth and More belonged to the "Cambridge moralists." John Locke (1632-1704) stated that "there is no truth universally accepted by mankind." He was also considered a hedonist. After Clarke, Shaftesbury, Mandeville, Butler, Wollaston and Hutcheson, we come to the great David Hume (1711-1776), a Scottish philosopher and historian. He published "Inquiry into the Principles of Morals," which was an exposition of the leading principles of the Utilitarian system. Adam Smith (1723-1790), Scotch political economist, wrote a book entitled "Wealth of the Nations," which has become very famous. It is considered one of the most important works on political economy ever written. We see now, in our outline of ethics, how it begins to touch economics, with which we are particularly concerned in the present day. There can be no sharp separation of ethics and economics. Sound economics must be based upon ethics, or there will be mass rebellion sooner or later. That rebellion is taking place now in the medical and dental professions, and accounts for the movement toward socialized medicine and dentistry. We shall say more about this particular movement later on in this paper.

Now we come to an interesting development called "The Intuitional School." Leading figures in this school of thought are Price, Read, Stewart and Whewell. In the encyclopedia, "Intuitionalism" is defined as "the name of a theory that our knowledge of at least some fundamental principles, whether of metaphysics or of ethics, is due to the fact that they present themselves as true in their own right, and, therefore, need no proof of any sort." Many of us are intuitionalists, both by choice and by instinct. Women are con-

sidered to be more intuitional than men, at least about small things. I shall not argue that point. All of you have your opinions regarding that, and those opinions are probably, in most cases, intuitional.

Utilitarianism sheds a light upon such names as Paley, Bentham and Mill. The Utilitarians adhere to the theory that the basis of moral distinctions is found in the utility of actions. Utilitarianism holds that the greatest happiness for the greatest number should be the goal of all political and social institutions, and that virtue is founded in utility. We must certainly consider the doctrine of Utilitarianism in working out our dental and medical problems with which we are now confronted.

It is probable that no one school of thought is entirely right. Most of them, in some aspects, are worthy. The standard for our moral concepts has been debated for centuries and, in all probability, will continue to arouse differences of opinion for all time to come. Some think of this standard as God's will, technically known as "theological voluntarism"; some conceive it as pure reason, or "rationalism"; some consider it as pleasure, of either the individual or the community, called "hedonism"; some think of it as perfect biologic adaptation to environment, or "biologism," and some think of it as perfection. Those who adhere to such ethics of self-realization are called perfectionists and their theory is known as "perfectionism." Kant is the great modern rationalist, with whom we are all familiar, at least by name.

ETHICS AS APPLIED TO DENTISTRY

Our discussion of ethics so far has largely concerned man and his moral responsibility. It may be rather difficult to establish the relationship, even though there are those who speak with great positiveness or conviction when a question of right or wrong is presented. Positivism is usually a cloak to cover up ignorance. The psychology of it is comparatively simple. The positive person subconsciously realizes his inability to arrive at a correct conclusion, the cause of this inherent inability usually being his own ignorance. Not having enough knowledge to launch an intelligent argument, he comes out flat-footed and says that such and such is so. The wise man goes slowly, knowing that even apparently small questions of ethics involve deep abstractions.

Heretofore, the ethics of dentistry has been concerned, rightly or wrongly, chiefly with the relationship between the individual dentist and the individual patient. At the present time, we must admit that ethics in the dental profession covers a broader field. Owing to a number of conditions, some of which I shall mention later, the ethics of dentistry now may be said to concern the dental profession as a whole and the general public. An indication of this is furnished in the present overwhelming sentiment on the part of the public for some kind of socialized dentistry and medicine. For a long while, the dental and medical professions have been self-governing, in every sense of the word. The dentist has defined, without assistance from the laity, all phases of his relationship with the laity. Until the recent depression, the general public was willing enough to subscribe to the ethical tenets of the dental profession; or, to state it differently, its opposition was not strong enough to kindle antagonism. I do not mean to infer that the ethics of the dental profession has been unfair to the public. The condition of discontent has been brought about by the fact that for the last several years there has been a profound change in the economic and social structure of the

country, and this change has had its effect on all professions and industries. The dental and medical professions have been the last of these to be affected, and the fact that they are compelled only at this late date to make certain changes in their relationship with the public is highly complimentary to both of them. It may indicate that the members of these professions generally have been men of high integrity and intelligence, and the public has been willing to leave in their hands, with implicit confidence, all questions regarding fees and other elements that enter into professional conduct. No man is infallible, and it is to be expected, in these times of stress, that dentists and physicians cannot always, by intuition, arrive at a correct fee. The law of supply and demand applies in dentistry as it does in all other fields of endeavor. Certain members of the general public are able to pay a stipulated fee without pinching themselves financially. Others, less fortunate, have been unable to pay even the average fee for dental and medical service. As a result, they have been forced to go without adequate dental and medical care. The poorest of them have been admitted free to charitable institutions, but those occupying the stratum between the poverty-stricken and the rich are unable to meet the usual scale of fees and are not considered eligible for charitable treatment. This class usually includes the small-salaried man with a growing family. He concludes, and rightly so, that he should be able to procure for himself and his family treatment at a price that he can afford to pay. The health of the people is the supreme obligation of any nation. It transcends the opinionated wishes of all classes, even the professional classes. The discontent which now exists cannot be laid entirely at the door of the individual dentist, for most dentists are honorable and endeavor to bear in mind, at all times, the economic welfare of society. More properly, the blame can be placed on the antiquated economics and ethics that have heretofore governed the health professions. Dentists have realized, as individuals, that there is a great disparity in the ability of the people to pay standard dental fees. Most dentists and physicians have attempted to overcome this difficulty by establishing what has been known as a "sliding scale" of fees. They have charged the well-to-do large fees, claiming that only by so doing are they able to treat the poor for a very low fee, or no fee at all. The middle classes have been charged fees that have approached what is known as the standard charge. The practice of charging the well-to-do exorbitant fees in order to finance the treatment of the poor would certainly not be considered ethical by any of the thinkers heretofore mentioned. It is the duty of the public-at-large to care for the needy and indigent. By charging the well-to-do unreasonable fees, the responsibility is placed on an individual rather than on society in general. This is wrong, even though the dentist or the physician may possess a superhuman intelligence that enables him to tell just how much to charge the fortunate elect. In America, we have a wholesome fear of anything that savors of socialism. If we think about the matter seriously, we must admit that something must be done for that large number of our citizens who need adequate health treatment and are unable to obtain it. So-called "socialized dentistry" is an outgrowth of this deficiency in our social structure. The label is worse than the thing itself, as the idea behind the movement is ethically sound. With all revolutionary changes, there is always danger that the radical element will gain the ascendency and carry the revolution beyond the bounds of justice and common sense. Socialized dentistry,

regardless of what we may call it, is no longer something far removed and speculative. So strong is public opinion favoring it that it is becoming an actuality. If the dental profession is wise, it will realize that it cannot stem the tide. It is not too late to control and direct it with an understanding and adequate dental leadership. Some of us may not know that the dental and medical professions have already recognized that some form of socialized dentistry and medicine is to be reckoned with, and have wisely taken a cooperative attitude. Official reports on the subject have been issued not only by the American Dental and American Medical associations, but by the American College of Surgeons and the committee appointed to investigate the costs of medical care. The reports of these associations are rather brief, and since they harmonize in many particulars, it will be worth while to quote both of them verbatim. Each paragraph of these reports should be of vital interest to every dentist who has the welfare of his profession at heart. The report of the American Medical Association says:

1. All features of medical service in any method of medical practice should be under the control of the medical profession. No other body or individual is legally or educationally equipped to exercise such control.

2. No third party must be permitted to come between the patient and his physician in any medical relation. All responsibility for the character of medical service must be borne by the profession.

3. Patients must have absolute freedom to choose a legally qualified doctor of medicine who will serve them, from among all those qualified to practice and who are willing to give service.

4. The method of giving the service must retain a permanent confidential relation between the patient and a "family physician." This relation must be the fundamental and dominating feature of any system.

5. All medical phases of all institutions involved in the medical service should be under professional control, it being understood that hospital service and medical service should be considered separately. These institutions are but expansions of the equipment of the physician. He is the only one whom the laws of all nations recognize as competent to use them in the delivery of service. The medical profession alone can determine the adequacy and character of such institutions. Their value depends on their operation according to medical standards.

6. However the cost of medical service may be distributed, the immediate cost should be borne by the patient able to pay at the time the service is rendered.

7. Medical service must have no connection with any cash benefits.

8. Any form of medical service should include within its scope all qualified physicians of the locality covered by its operation who wish to give service under the conditions established.

9. Systems for the relief of low-income classes should be limited strictly to those below the "comfort level" standard of incomes.

10. There should be no restrictions on treatment or prescribing not formulated and enforced by the organized medical profession. (Adopted by the House of Delegates, June 12, 1934.)

The report of the American Dental Association follows:

1. In all conferences that may lead to the formation of a plan relative to this subject, there must be participation by authorized dental representatives.

2. The plan should provide dental care for indigents and needy children.

3. The plans should give careful consideration to the needs of the people, the obligations to the taxpayer and the interests of the profession.

4. The plans should be flexible, so as to be adaptable to local conditions.

5. There must be complete exclusion of proprietary or profit-making agencies.

6. All features of dental service in any

method of dental practice shall be under the control of the dental profession, as no other body or individual is educationally equipped to exercise such control.

7. All legally licensed dentists of a locality should be eligible to serve under such regulations as may be adopted.

8. Persons eligible to such services should be free to choose their dentist from the list of those who have agreed to furnish services under the adopted regulations.

9. Freedom of practitioners to accept or reject patients and freedom of all persons, who so prefer, to obtain dental service other than that provided by such plans, must be assured.

10. An adequate program should be provided for public education on the need of and the opportunities for dental care. (Adopted unanimously by the House of Delegates, Aug. 9, 1934.)

Of course, the success or failure of these revolutionary changes in dental and medical practice will depend largely on how faithfully the plans are carried out and under whose direction they are put in operation. If we assume that this new development will not be abused by those having charge of it, it would appear to have, among others, the following advantages:

1. It would afford treatment to all classes of society.

2. It would terminate the unfortunate discrimination against the well-to-do.

3. It would make the general public responsible for the care of the indigent, through taxation or other means. This is as it should be. The people of a community or state should be more anxious to preserve the health of the people than they are to preserve that of their live stock.

4. It would put the healing professions ethically and economically in accord with the changes now taking place in society. The professions, which heretofore have been accountable only to themselves, would, under the new order of things, be accountable to society in general.

5. It would correct many abuses now existing in private practices.

6. Broadly speaking, it would humanize medical practice, rather than stifle it, as some have contended.

7. It would be of vast benefit to the recent graduate.

8. It would give the public a better idea of health problems.

9. It would tend to unify all health activities.

Under possible disadvantages may be mentioned the following:

1. It may destroy, to some extent, the personal relationship between patient and practitioner.

2. It may make medicine and dentistry less attractive to prospective students.

3. It may lower the income of certain practitioners disproportionately to the cost of obtaining their education, and may, therefore, discourage specialization.

4. It may make it still harder for certain worthy practitioners to gain a living commensurate with their ability. On the other hand, it may increase the incomes of the incompetent.

5. There is a very strong likelihood that politics will intrude, from the standpoint of both the state and community and the practitioners themselves.

6. There is danger of the conduct of the profession getting out of control of those who are most qualified to exert it, the practitioners themselves.

It is a big problem and one that will have to be worked out with care and infinite wisdom. Revolutionary changes do not reach a state of perfection the day after they are conceived. The practitioners and the public should acquaint themselves with the abuses now existing in foreign countries and make an effort to prevent them. Any new and profound problem is always fraught with possibil-

ities for good or bad. There is a general agreement among the leaders in the profession that dentistry must keep in step with the progress of the times. The procession is going past, and they must either join it or be left out. It is much better for them to join in now, and assume the leadership, than to lag behind and let the movement get completely out of their hands.

As you will recall, I mentioned in the early part of this paper the Utilitarian school of philosophy, which holds that the greatest happiness for the greatest number should be the goal of all political and social institutions. We, as a profession, believe this, and really there is no reason for thinking that this principle does not apply in dentistry when it applies to all other individuals or agencies having to do with the common welfare of the people.

The future of the dental profession will be determined by the needs of the public and not by the needs of the dentist. Dentistry belongs to the public, not to the dentists. The old philosopher who said "The health of the people is the supreme law" was not wrong, and the public has a habit, sooner or later, of demanding those things to which it thinks it is entitled. They have already demanded and are receiving these things from commerce and the government. They are now demanding them of the healing professions, and if those professions are wise, they will give a considerate and thoughtful attention to those demands.

PHYSIOLOGIC AND TRAUMATIC APICAL RESORPTION

By JOHN ALBERT MARSHALL, D.D.S., Ph.D., San Francisco, Calif.

ON several occasions during the last five years, I have spoken on the similarities of and differences between physiologic and pathologic, or traumatic, apical resorption. As the various tissue changes produced in the hard and soft structures have been illustrated by photomicrographs and described in several papers, they will be alluded to only in passing. It will be necessary to compare briefly the pulps of the deciduous and the permanent teeth.

At the time when teeth erupt through the overlying soft tissues into the oral cavity, the pulp has yet to complete the formation of radicular dentin. It is probable that the rate of dental formation depends, to some extent at least, on the state of nutrition and health. It has not been definitely established that maternal malnutrition produces dental hypoplasia in the fetus; but, from the clinical aspect, it is evident that this condition is less apparent in deciduous teeth that are formed before birth; which indicates that the prenatal dental development is probably less subject to variations in nutrition than that of the extra-uterine period. Even though the fetal growth is more rapid, the rate of dental development is probably greater and the integrity of the dental structures more nearly uniform.

As an example of differences in rate of growth, the following may be cited: A 9-weeks fetus measured about 6 cm. in length; another specimen of 7½ months,

30 cm. The rate of intra-uterine growth then amounts to 500 per cent, if it can be assumed that this fairly represents the rate. Similar comparisons of new-born infants indicate that the average length is 50 cm. Although the average height of man has been variously estimated, an average may be postulated at 5 feet 9 inches (175.5 cm.). This represents an increase of 350 per cent since birth as against 500 before, but it is accomplished in years instead of months.

All growth phenomena occur as a part of a series of active and inactive stages of biologic force. Robertson[1] constructed

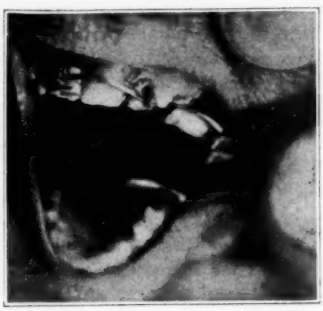

Fig. 1.—Ribbon arch and bracket bands. The maxillary permanent left lateral incisor is tipped lingually and the maxillary permanent right center incisor is tipped labially.

a number of growth curves based upon data collected by the British Anthropometric Committees. These curves in man, corresponding roughly to those representing the growth of laboratory animals, can be divided into three growth cycles. The first is from birth to about 18 months. Then a slight lag occurs, following which the first cycle continues to about 4½ years. This is the period of most active extra-uterine growth. The second is variously estimated, but appears to be from about 10 to 17 years. There may be several retardations during this cycle. The third period, which extends from 17 to 25 years, is not definitely set.

Thus, it is evident that there are latent periods of cellular activity during which the rate of skeletal growth is reduced. This probably is true also of dental development, although it is difficult to prove. It is during the first period of active growth that resorption begins.

After the roots of the deciduous teeth have been completely formed, the functioning odontoblasts gradually become inactive, and several years elapse before the root begins to be resorbed. The earlier stages of normal apical resorption affect alike the cementum and the dentin. The barely closed apical foramen is enlarged, which permits an increase in the blood supply to the dental pulp. During periods of active resorption, of either the physiologic or the pathologic type, hyperemia and other symptoms of inflammatory phenomena exist. In the case of resorption of deciduous roots, it is observed that the pulp as well as the peridental membrane shows enlarged blood vessels. General practitioners of dentistry as well as specialists in operative dentistry for children have observed frequently the clinical differences in the degree of pulp response to devitalizing fiber. In the case of the deciduous teeth, the result may be achieved in twenty-four hours, but a longer time is required to produce devitalization of pulps in permanent teeth, owing to the more rapid absorption of the drug in the first case. This, in turn, is possible because of a relative enlargement of the apical foramen and an increase in the blood supply, and is another example of growth phenomena. Normal resorption may be delayed by several conditions. Perhaps the most usual is infection indirectly by caries and which is transmitted to the pulp, or di-

1. Robertson, T. B.: Principles of Biochemistry, Philadelphia: Lea and Febiger, 1920, p. 472.

rectly by contiguity from an adjacent tooth; or infection transmitted from another focus by the blood stream. A second condition is prolonged malnutrition of either dietary or endocrine origin, or both. Equal importance is attached to infectious disease and prolonged convalescence. In each of these conditions, the local nutrition of the part and the normal waste removal may be interfered with.

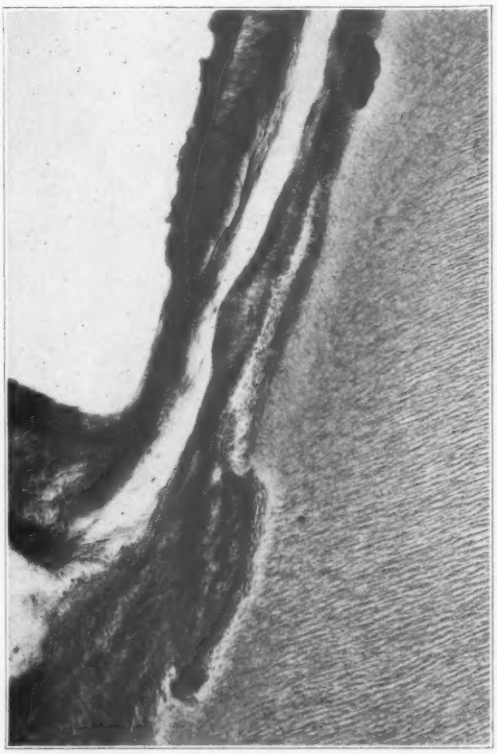

Fig. 2.—Resorption on labial aspect of left lateral incisor.

The relationship of blood supply to formation of bone or its resorption has been studied in many laboratories in both this country and Europe. It has been well established that, during the process of bone formation, stasis occurs in the fluids of the surrounding connective tissues. When the opposite condition, resorption, arises, the reverse process develops; namely, a marked hyperemia or increase in the blood supply. When muscular stress or accident stimulates the formation of new bone, it is preceded by hyperemia, which induces preliminary resorptive processes and later rarefaction of bone. The same phenomena are observed in the resorption of roots, either deciduous or permanent.

All of the work that I have reported has shown definitely these changes in blood supply.[2] During resorption, the typical hyperemia is demonstrated; but during rebuilding of tissue, the capillaries are reduced in size and stasis occurs. The decrease in the rate of flow of blood produces a like effect in the lymph. Thus, the lymph, by remaining undisturbed, reaches a point of minimum flow, a condition which favors the deposition of the lime salts. There is also clinical proof of this point. When normal bone is cut superficially, no bleeding occurs; but, in rickets, small capillaries begin to ooze tiny droplets of blood when the bone surface is cut. In the one instance, no bone resorption is present, but, in the second, the rarefactive processes are preceded by hyperemia. In fact, the favorable effect of sunlight on healing of fractures is due, in part at least, to the hyperemia thus

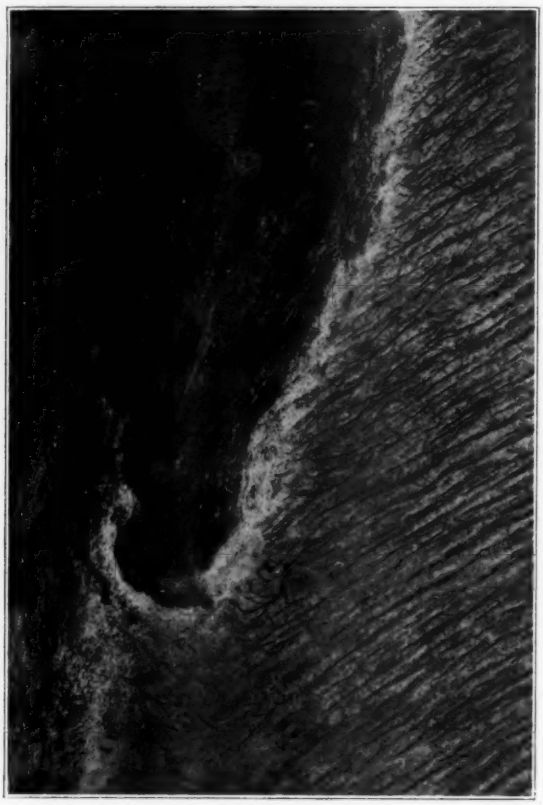

Fig. 3.—Area shown in Figure 2 (higher magnification).

2. Marshall, J. A.: Internat. J. Orthodon., 20:731 (Aug.) 1934.

induced, which promotes the necessary preliminary resorption at the line of fracture.

Descriptions of tissue changes in the rhesus monkey, which have been reported previously, have not included those occurring when crowns of anterior teeth are tipped labially or lingually. Bracket bands and a ribbon arch placed on the maxillary permanent left lateral incisor and permanent right central incisor produced this type of movement. Serial sections were cut beginning at the distal aspect of the left lateral incisor and continuing around the arch past the median line to the distal aspect of the right lateral incisor. These sections present a longitudinal labio-lingual picture of the tooth. In order to visualize the result, it is necessary to review for a moment the normal position and curvature of maxillary permanent central incisors. These teeth are not straight as in man, but curve from the tip of the root apex to the incisal edge

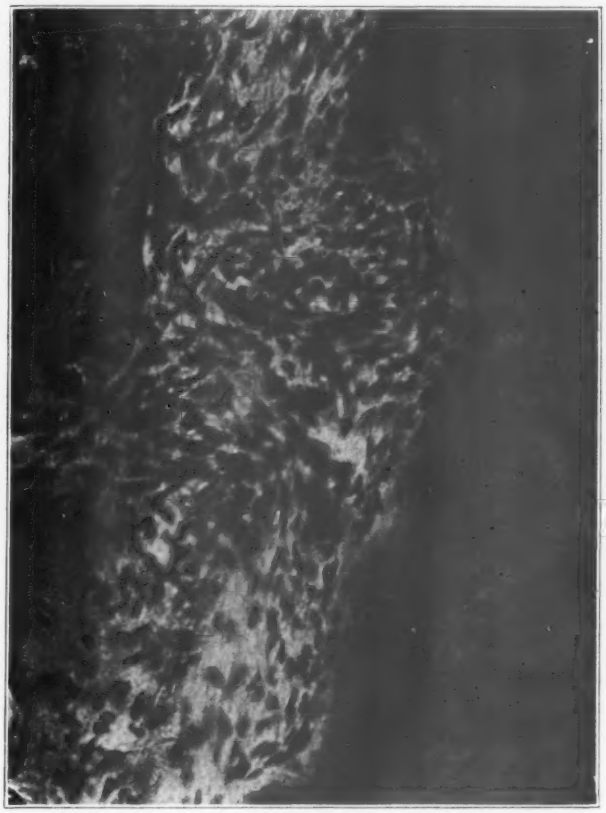

Fig. 4.—Degree of inflammatory reaction as demonstrated by hematoxylin and eosin stain.

nearly into an arc of a quarter circle. These are the only teeth of the rhesus monkey having such an arcuation, the others being straighter and resembling in many respects the human teeth. Pressure on central and lateral incisors produces, therefore, movements somewhat different from those obtained on patients. In this experiment, the left lateral crown was tipped lingually, which forced the root labially and toward the partly formed and unerupted permanent cuspid. This is clearly indicated in Figure 1. It will be observed in Figure 2, a low power magnification, that the labial aspect of the left lateral incisor shows slight resorption in several places. This is probably the result of two pressures, one exerted by the developing cuspid and the other by the band and arch wire.

Figures 3 and 4, higher power photomicrographs of the same area, show the degree of invasion of the peridental membrane into the dentin. Not only was the tooth involved, but the bone adjacent to the unerupted cuspid also was being resorbed. In Figure 5, it will be noted that the resorption of bone occurs simul-

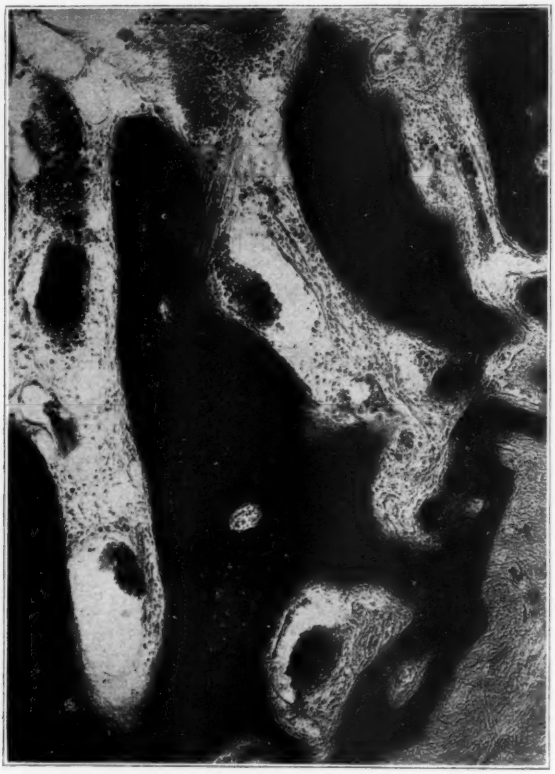

Fig. 5.—Enlargement of capillaries and bone resorption.

taneously with the growth of the developing cuspid and is hastened probably by the additional pressure exerted by the labial movement of the left lateral incisor root. There is shown also the proteolysis of the bone matrix following its decalcification.

The maxillary permanent left central incisor, on which no direct pressure had been placed, was not resorbed. The apical foramen of this tooth is seen in Figure 7. Its contour is normal, and the adjacent bone is normal. A blood capillary is demonstrated, extending from the inner aspect of the foramen through the peridental membrane into the alveolar bone. The lateral fibers on the lingual aspect are illustrated in Figure 8.

Apparently, there was a slight indirect pressure on this root, as the peridental membrane on the labial aspect presents some evidence of an inflammatory reaction. (Fig. 9.)

The effect of the labial coronal tipping of the right central incisor is evident in Figures 11 and 12. A portion of the root apex of the right lateral incisor has been resorbed from the pressure produced by the lingual radicular movement of the right central incisor. The resorption is not on the larger root of the central incisor, but on the smaller lateral root. These results are in agreement with those previously reported, for they indicate that animals on an unrestricted diet are not subject to resorptive processes to the same degree as those whose diet fails to meet nutritive requirements. (Figs. 10-12.)

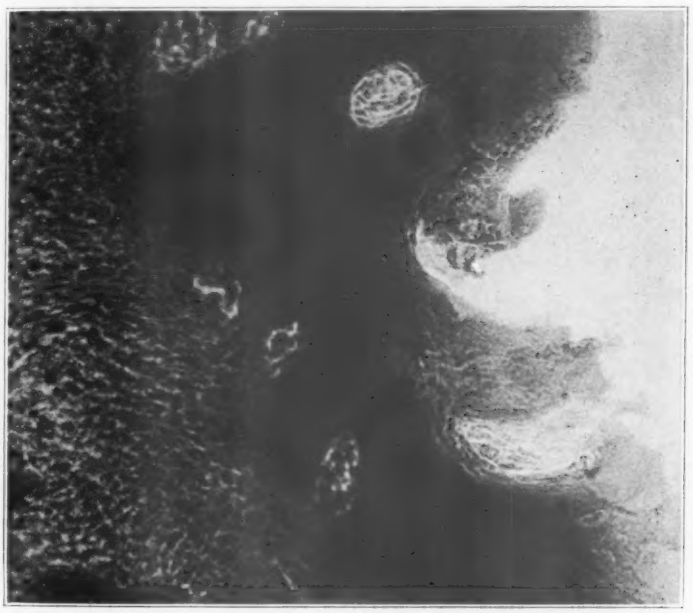

Fig. 6.—Proteolysis of bone matrix following decalcification.

It is recognized that these require-

ments include not only the dietetic optimum, but also the normal functioning of the organs, glands and tissues of digestion, absorption and excretion. Many attempts have been made during the last decade to revalue the predisposing and exciting causes of dental disease. None have seemed entirely satisfactory. Either too great an emphasis is placed on vitamins or calcium or calories, or else local factors are considered preeminent. It has been suggested that dysfunction of endocrines may be wholly, or in large part, responsible for dental disease. Two questions will perhaps help to clarify the situation. 1. What proportion of the population require dental treatment? A conservative figure is 80 per cent. 2. What physician will state that 80 per cent of the population suffer from glandular disease, such as malfunction of the thyroid? Or what physician will state that 40 per cent or 20 per cent are so afflicted? None. The situation is not so easily disposed of. There is no doubt that the various anatomic systems, including the nervous and the endocrine system, may be profoundly affected by malnutrition, but the picture must be seen from all angles before each figure or factor can be assigned to its proper position. Certainly the administration of thyroid, although practiced for the past thirty years, and therefore not new nor startling in originality, has not solved the ills dental, dietary or developmental of the nation.

Fig. 7.—Maxillary permanent left central incisor; apical foramen and blood capillary extending from the pulp through the peridental membrane into the bone.

Unfortunately, there is at the present time a lack of agreement not only in methods of analysis, but also in the interpretation of results. For example, the flow of

inorganic salts from the alimentary canal to the blood stream and thence to bone or other normal calcifying areas has been studied by Speed and his co-workers. It was pointed out that the chemical analysis of blood serum, to determine the amount of serum calcium, shows merely the relative amount of calcium in the blood stream, but gives no indication whatever of the direction of the flow, whether it be toward the excretory channels or into the bone. The research consisted in performing parathyroidectomy on dogs and controlling the tetany so induced by giving calcium lactate and thyroid extract. Thereafter, experimental bone fractures were made and the bone and the blood serum were analyzed to determine the amount of calcium present. Under conditions in which a delay of calcification occurred as indicated by roentgenograms taken periodically, it was found that the calcium stream was being diverted from the osseous structure rather than turned into it. Not only was the blood calcium low, but also, through parathyroidectomy,

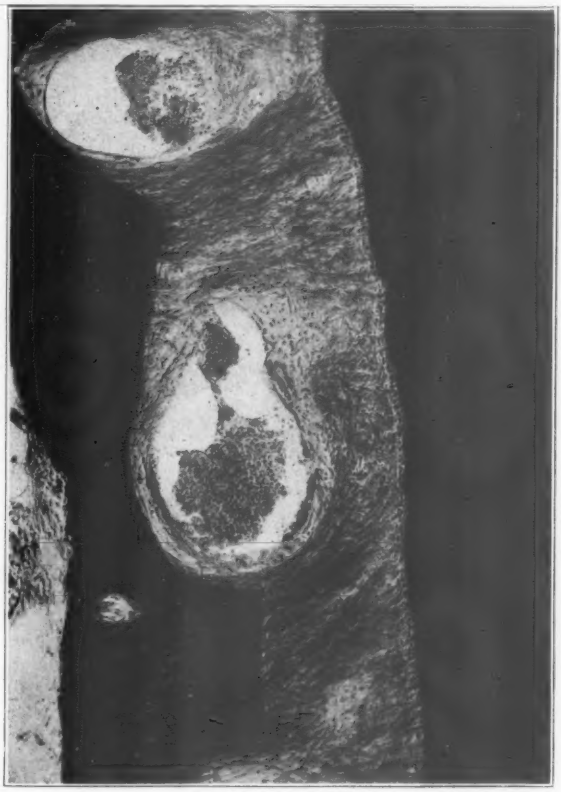

Fig. 8.—Lateral fibers in peridental membrane on lingual aspect of left permanent central incisor.

a delay in healing of the fractures resulted.[3]

It has been suggested also that skeletal muscle serves as a temporary source of lime salts that have been mobilized by the action of parathormone. If experiments on animals surviving thyroparathyroidectomy are confirmed, this hypothesis will be untenable. It is reported that when both thyroids and parathyroids are removed, the calcium percentage in the muscle is diminished. The fall is said to be more gradual and of a less degree than that in the blood stream. Although the administration of parathormone did not give concordant results, in no instance did the muscle calcium fall after this treatment. In fact, the changes in the one tissue were paralleled by those in the other. If muscle calcium served as a source of lime, it would be lowered un-

Fig. 9.—Labial aspect of left maxillary permanent central incisor, showing dentin, cementum, peridental membrane and bone.

3. Nicolau, C. T., and Gingold, N.: Arch. roumaines path. exper. et microbiol., 4:119-134 (March) 1931.

der conditions of hormone administration. There are other experimenters who are equally insistent that thyroparathyroidectomy does not produce *any* change in tissue calcium.[4]

Emphasis must also be laid on the fact that the mineral parts of bone are not merely inert masses of substance unlikely to be changed or disturbed once they are deposited. On the contrary, they are involved constantly in the interchange of inorganic salts which occurs between the circulatory fluids, the bone and other tissues and organs. This is shown very clearly in certain experiments on fractured bones. Segments of fractured bone (radii of rabbits) contain more calcium than does normal bone. This is due, probably, to the setting free locally of salts from the bone fragments and to the deposition of calcium from the blood serum.[5] An endocrine interrelation has been demonstrated as well. The calcium salts discharged into the blood stream by osteolysis of the bone fragments stimulates endocrine function so that recalcification proceeds more actively.[6] It has been stated also that in bone injuries and callus formation, the serum calcium rises.[7]

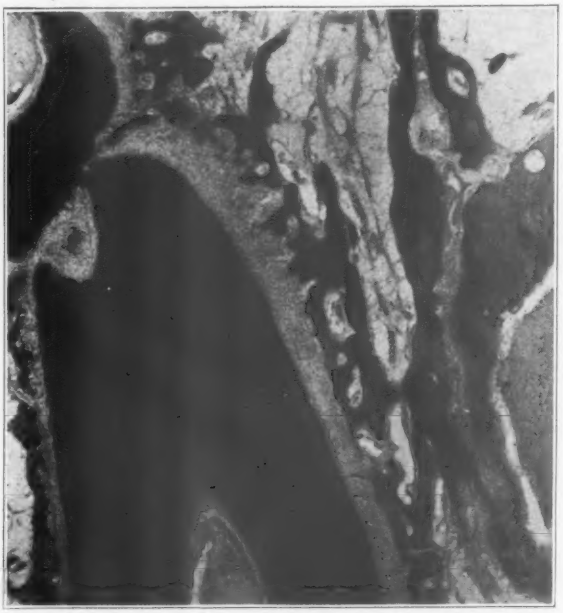

Fig. 10.—Apex of right lateral incisor, longitudinal section. Above and to the left is the apical portion of the right central incisor in transverse section.

4. Underhill, F. P., and Jaleski, T. C.: J. Biol. Chem., 101:11-14 (June) 1933.

5. Loreto, C.: Ann. ital. chir., 9:1283-1289, 1930.

6. Schreiber, G.: Arch. Sc. Biol., 13:127-157 (Jan.) 1929.

7. Gussarow, I. I.: Arch. f. klin. chir., 155: 39-50, 1929.

The utilization of the inorganic substances depends on the digestive processes, both biliary and enzymatic occurring in the small intestine. For example, the importance of bile in maintaining a normal calcium-phosphorus balance is shown by the following experiment: When the bile is completely diverted through operative procedure, a progressive osseous decalcification occurs.[8] Furthermore, an acidosis develops and the blood calcium and phosphorus are lowered. The recent experiments of Greaves and Schmidt[9] dovetail very nicely with these facts; for they have shown that bile salts are necessary for the satisfactory absorption of vitamin D.

These observations, seemingly somewhat inconsistent, are gradually being correlated and the time is rapidly approaching when the metabolism of calcium and phosphorus will be understood as well as that of iron or oxygen. The

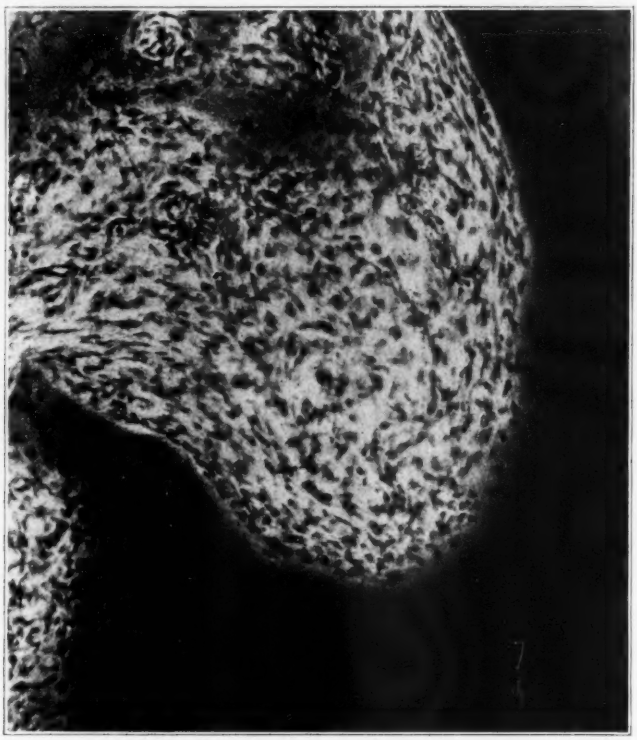

Fig. 11.—Apex of right lateral incisor.

8. Pecco, Renzo: Arch. ital. chir. 28:163-174, 1931.

9. Greaves, J. A., and Schmidt, C. L. A.: Proc. Soc. Exper. Biol. & Med., 29:373-377 (Jan.) 1932.

daily gram of calcium must be traced through the organs and tissues that the chemical changes taking place from absorption to excretion may be known.

The biochemical explanation of calcification of bone and tooth structure is based upon a study of the following systemic factors: (1) an adequate dietary intake of calcium and phosphorus compounds and of vitamin D; (2) the p_H value of plasma and intestinal contents; (3) the amount in blood plasma of calcium compounds and the proportions existing between the ionized and nonionized, and the dialyzable and nondialyzable substances; (4) the amount of phosphate compounds in blood plasma; (5) the normal amount of parathormone, and (6) the relative activity of the thyroid gland. The degree of importance of these various factors may be stressed by one worker and then depreciated by another. But all have suggested that the local activity of the tissues requires explanation,

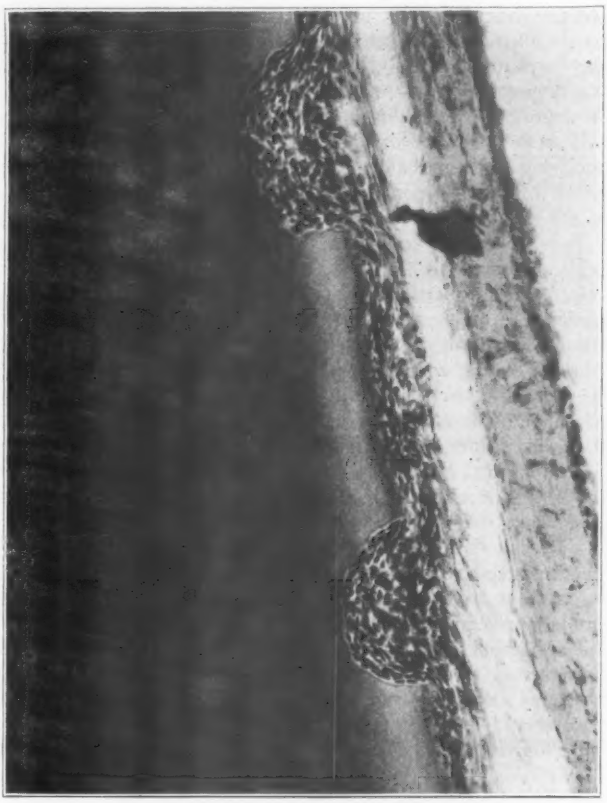

Fig. 12.—Dentin resorption on lateral incisor.

and the chemical field is not the only one concerned with the problem. The significance of the osteoblast is still in doubt, as well as the relation of cell to enzyme phosphatase.

It has been demonstrated by Kay[10] and his co-workers, as well as by Bodansky, that, during the formative period, when bone and tooth structures are being built, an enzyme, "phosphatase," acting on the hexosephosphates, normally present in the blood, precipitates these inorganic salts in the organic matrix of bone and tooth. Since the presence of phosphatase in calcifying cartilage is a demonstrable fact, a workable hypothesis is provided for the elucidation of the phenomenon of bone and tooth formation. Kay suggests also that the osteoblasts may secrete phosphatase. This enzyme produces a local increase of phosphate ions by hydrolysis of salts of phosphoric esters. Gradually, as the concentration increases, the solubility decreases, until deposition of calcium phosphate occurs. It is well established that enzymes, under the appropriate conditions, may accelerate a reaction in either direction. It is possible, therefore, that the decalcification occurring as a part of the process of resorption of bone and teeth is accomplished as a reverse reaction from ossification. The hyperemia preceding resorption carries the "phosphatase" to the area.

It is here suggested that root resorption, demonstrated experimentally in monkeys and observed on patients, may occur in the following manner: The slightest pressure on roots produces a localized hyperemia of both the peridental membrane and the pulp. This is probably the first stage in resorption. It is not known how the tissue effects the solution of the inorganic salts making up the hard structures. If one may be permitted to apply tentatively to this problem the idea of the action of enzymes, a logical explanation similar to the following might be offered: As a result of a local trauma from pressure, the phosphatase, instead of aiding in the precipitation of phosphates, now effects solution of the lime salts and gradually produces a decalcification of the area involved. Following decalcification, proteolysis of the residual organic matrix begins, and thus both inorganic and organic parts of the hard tissues are removed. It is not apparent where the osteoclast aids in the process. This multinucleated giant cell has been described as a modified osteoblast, the modification being that of function rather than of structure. Wells has suggested[11] that cells in an area of active calcification might conceivably raise also the p_H of the matrix fluid. Such an increase in alkalinity is favorable for the deposition of lime salts. Carrying this idea farther, would it not be logical to assume that decalcification is a part of phophatase action, but in the reverse direction? It is aided by the secretion of a fluid of lower p_H, that is, of greater acidity. This hypothesis has scant support from experimental evidence, but it may be pointed out as well that no facts have been advanced to refute it.

10. Kay, H. D.: Physiol. Rev., 12:384 (July) 1932.

11. Wells, H. B.: Arch. Int. Med., 15:574, 1915; 7:721, 1911.

RELIABILITY OF VARIOUS TYPES OF PULP TESTERS AS A DIAGNOSTIC AID*

By THEODORE KALETSKY, D.D.S., and ANNA FUREDI,† M.D., New York City

AWARE of the relative importance of pulp testing as a diagnostic aid, and because various types of instruments are offered the profession with claims of superiority one over another, we felt that a comparative study of these instruments would be not only timely but also enlightening.

Before going into the technical details of this report, it might be of interest to relate briefly the history of this work as it appeared in a study of the literature.

To quote a reference from an article written by Hermann Prinz[1] in 1919:

1. In a remarkable book by Magitot (Paris, 1867), the following statement is recorded: "This examination (of the dental system), under circumstances so obscure, demands careful attention. . . . Another method has also been proposed; it consists of causing an electric current to pass along the whole extent of the dental arches by means of one of the little induction apparatus so frequently employed nowadays in medicine. By the passage of a current so feeble as not to cause of itself any pain, the carious tooth will become the seat of an acute and clearly localized pain."

2. John S. Marshall (about 1891) in a paper entitled "Electricity as a Therapeutic Agent in the Treatment of Hyperemia and Congestion of the Pulp and the Peridental Membrane," makes the following statement: "As a means of diagnosis in obscure cases of the vitality or non-vitality of the dental pulp, I know of nothing so sure to demonstrate to a positive certainty these conditions as the electrical currents, both the galvanic and the faradic. In the more obscure cases, however, the faradic is superior to the galvanic, for if there is the slightest vitality remaining in the pulp, it will demonstrate it instantly by causing a response in the tooth."

3. In 1896, Woodward demonstrated the following: "If a few cells of a cataphoric apparatus are in action, and the positive electrode be applied to the dentin or metallic filling in a vital tooth, while the negative pole is at the cheek or wrist of the patient, a distinct sensation should be felt, while in case of a dead pulp there will be no response; usually even a small filling will transmit a distinct shock in a vital tooth, which is absent in a devitalized tooth. A mild interrupted current has also been used for the test."

About 1901, several of our colleagues abroad attempted to standardize the instruments employed in, and the reactions from, electrical stimulation of the dental pulp, and at that time conducted some important experiments, with reliable and instructive results.

*A report from the New York Institute of Clinical Oral Pathology, Inc.

*Read before the American Society of Oral Surgeons and Exodontists, St. Paul, Minn., Aug. 3, 1934.

*Aided by grants from the Research Commission of the American Dental Association and the American Society of Oral Surgeons and Exodontists.

†Pathologist.

1. Prinz, Hermann: Diseases of the Dental Pulp, D. Cosmos, 61:312-313 (April) 1919.

Frohmann[2] was an enthusiastic advocate of this principle and in his work called that point at which the tooth first responded to an electrical stimulus "the threshold of irritability." We believe this term excellent, and I shall use it throughout this report.

In 1901-1902, Fuyt[3] conducted some experiments using the primary current of an induction coil to which were attached two electrodes. One was held in the patient's hand, and the other, a fine platinum pin covered with cotton and saturated with water, was applied to the tooth. He used up to 2 volts, controlling the current with a rheostat.

He observed that: 1. Normal teeth reacted to this current when moist. 2. Nonvital teeth did not react to much greater amounts of current. 3. Teeth with inflamed pulps had a much lower threshold of irritability (less current) than normal teeth. 4. Teeth covered with normal enamel responded best when tested near the neck.

At about the same time, Schroeder[3] employed an instrument using the secondary current of an induction coil to which were attached two electrodes. One was held in the patient's hand and the other was applied to the teeth. In obscure cases, he claimed, by applying one of the electrodes extra-orally on the skin overlying the affected part, to be able to determine which was the offending tooth, it becoming sensitive when the current was applied.

Also, at the same time, Hafner[3] used alternating and direct currents and made similar observations regarding the effect of the electric current on vital teeth. His instrument was one controlled with a rheostat using up to 5 volts. It also had two electrodes, one of which the patient held in his hand. The other, made of vulcanite with a copper point, was applied to the tooth. In order to obtain the most accurate interpretation, he used as a control another tooth, which was normal and as close to the tooth in question anatomically as any tooth he was able to obtain. He applied the rubber dam on the tooth in question and on the control, and he found invariably that the diseased tooth either did not respond to a large amount of current or else responded violently to a comparatively small amount, which did not affect the control tooth. He found that the pulp of the pathologic tooth was either dead or inflamed.

Although Fuyt used the primary, Schroeder the secondary and Hafner the direct current, the results were essentially the same: 1. Teeth with normal enamel and normal pulps gave definite reactions, more or less painful according to the individual, regardless of the instrument used. 2. Teeth with inflamed pulps reacted to a much smaller amount of current than teeth with normal pulps. 3. Devitalized teeth did not respond at all.

In 1904, Schroeder[3] noted that the resistance of a given thickness of enamel was twenty times greater than that of a double thickness of dentin. He determined this by placing a definite thickness of enamel in series and noted the mild response on the patient's lip and tongue. When a double thickness of dentin was used, the response, with the same amount of current, was much more marked.

Schroeder also observed that:

1. Incisors had a lower threshold than bicuspids and molars.

2. Teeth of young persons were more

2. Frohmann, D.: Moderne diagnostische Methoden für die Erkrankungen der Pulpa und ihrer Ausgänge, Deutsche Monat. f. Zahnheilk., 1907, p. 153.

3. Schroeder, H.: Der Induktionsstrom als Diagnostikum in der Zahnärtzlichen Praxis, Deutsche Zahnheilk. in Vorträgen, 1907, No. 2.

sensitive than those of adults; giving as his reason the fact that, in early life, the pulp canals and chambers are much larger and thereby offer a lessened thickness of enamel and dentin in resistance to the electric current. In adults, the pulp received a greater protection by the further deposit of dentin in the pulp chamber and canal, and by the deposit of calcium in dentinal tubuli; thereby offering a still greater resistance.

3. Different persons had different thresholds of irritability.

4. It was necessary, in order to make a correct interpretation of the response of a given tooth, to study the opposing or control normal tooth to note the variations.

5. The use of narcotics and local anesthetics raised the threshold. This varied with the drug used, the method of administration and the time elapsed after administration.

6. There was a variation when teeth of the right side were tested and the electrode held in the left hand, and uniform results could be obtained by changing the electrode to the hand corresponding to the side tested.

7. Chronic alcoholics had a lower threshold.

8. Various stages of inflammation of the dental pulp required lesser amounts of current to obtain a response. After making microscopic studies of pulps previously tested, he concluded that teeth with acute pulpitis had an abnormally low threshold and teeth with chronic pulpitis with definite suppuration had a much higher threshold than normal.

9. It was necessary to isolate the teeth with rubber dam, especially when the crowns were in close contact or large metallic fillings were present.

10. Silicates, oxyphosphates and cement fillings conducted current almost as well as metal. Guttapercha was the exception.

11. It is important for the operator to avoid touching any filling material in making the test.

12. The control tooth should be tested in exactly the same place as the tooth in question.

13. Normal dentin will respond at an extremely low threshold. In older patients, with marked deposits of secondary dentin, when the organic material in the dentin has undergone calcific degeneration, very often the threshold is extremely high, and sometimes no response is felt to maximum stimuli.

14. Deciduous teeth with absorbed roots had a high threshold.

These findings of Schroeder were confirmed by Hesse[4] and Frohmann.[2] In their investigation, they stressed the importance of observing the length of time that the sensation lasted after the application of the current. In other words, in a normal pulp, after the application of the electrical stimulus, there is a slight sensation, which disappears almost immediately on discontinuance of the electric current. In cases of various degrees of pulpitis, this sensation is greatly prolonged and with different degrees of intensity. In partially gangrenous pulps, they observed that a definite time elapsed from the instant the current was applied until the patient complained of a sensation. Some instruments used abroad at the present time are based on this principle. (Weber.[5])

4. Hesse, Gustave: Ueber den Nachweis des Lebenszustandes der Pulpa unverschrt aussehender Zähne durch den elektrischen Strom, Deutsche Monat. f. Zahnheilk., 1907, p. 191.

5. Weber, Rudolf: Beiträge zur Physiologie des gesunden und Kranken Zahnmarkes I. Ueber die Chronaxie der sensiblen Nervenendigungen in gesunden Zähnen, Deutsche Monat. f. Zahnheilk., 1933, No. 17.

In testing nonvital teeth, Schroeder and Adolf Witzel[3] reported that when the electrode was applied to large fillings or to a thin enamel covering of a large filling, a response was obtainable. Schroeder felt that the current was conducted through the dentin to the nerves of the peridental membrane.

They also noticed that:

1. When guttapercha was used as a root canal filling, the tooth would have an extremely high threshold or would not respond at all. When other root filling materials were used, responses near the normal threshold were obtained.

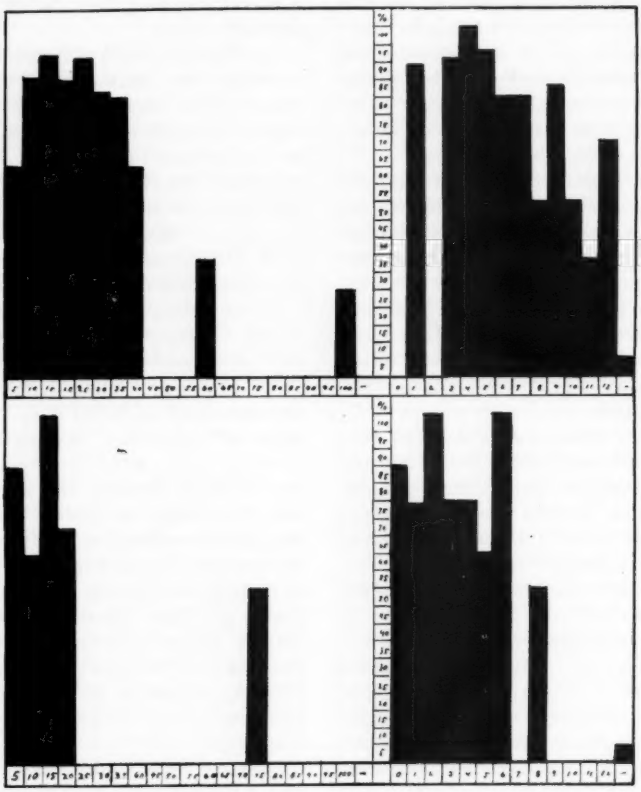

Fig. 1.—Incidence of normal pulps for the entire mouth. In Type I (above, left), practically all normal pulps respond up to 40 volts. In Type II (above, right), the normal pulps appear frequently throughout the entire scale. In Type I (below, left), practically all normal pulps appear within a range of 20 volts from the control tooth. In Type II (below, right), practically all normal pulps appear within a variation of 6, or about 50 per cent of the scale. The percentage of accuracy is only 82 to 85 per cent. (The horizontal figures in Figures 1-5 indicate voltage.)

2. Devitalized teeth in which the enamel is apparently intact do not respond to the pulp tester unless the peridental

membrane is inflamed. In this case, the threshold is very high.

3. Teeth with periapical involvement and those with large fillings in the crown responded sharply to small amounts of current when the electrode was applied to the fillings.

4. Teeth that were traumatized should not be tested until all clinical evidence of pericementitis or other sensitivity disappeared, as responses were distorted and might have been obtained from the peridental membrane.

Schroeder used the pulp tester: (1) to test the profundity of anesthesia; (2) to study the vitality of pulps after an injury, and (3) to determine the condition of the pulp in forced regulation of the teeth.

Frohmann,[2] in 1907, was the first to note that he was able to determine which root of a multirooted tooth was normal by studying the comparative responses in different parts of the crown.

Borsche and Wolfe,[6] in 1929, used high frequency current. They were able only to differentiate vital and nonvital nerves of the pulp.

Since this time, many of these observations were confirmed and others noted by clinicians who have reported their findings in American periodicals. Extremely valuable clinical observations were contributed by Machat,[7] Walker,[8] Prinz[1] and Raper.[9]

Reiss and Furedi[10] reported the microscopic findings on the pulps of 130 teeth previously tested with faradic current. The instrument used was one wherein either alternating or direct current was controlled with a rheostat. The voltage varied from 1 to 100. There were two electrodes: one applied to the hand and the other to the tooth.

The following clinical observations were noted:

1. There is no definitely normal average that can be applied universally.

2. The response of an individual to an electrical stimulus is an indication of the condition of the reflexes. Patients respond differently on different days and at different hours of the same day. The variation is not great enough to be confusing.

3. Metallic fillings make good conductors of current, while silicates, cements and guttapercha make poor ones.

4. In some instances, it is necessary to isolate the teeth with the rubber dam to preclude the presence of too much moisture.

5. Teeth imbedded in tumors apparently retain normal vitality.

6. Second molars that have third molars impacted against them usually have a high threshold. After removal of the impacted tooth, the second molar returns to normal.

Their pathologic studies will be discussed later on.

In planning our studies, we believed that it would be well first to verify the findings of Reiss, who conducted the pulp testing, by a continued study similar to his, and using the same instrument. We also examined 130 teeth and followed essentially the same technic. In addition,

6. Wächter, Karl Adolf: Zur Elektrodiagnostik von Pulpa und Wurzelhaut, Inaug. Dissertation, Göttingen These, 1931.

7. Machat, B. B.: Dental Electro-Diagnosis, D. Cosmos, 61:123 (Feb.) 1919.

8. Walker, Alfred: Faradic Current as Means for Determining Variations in Condition of Tooth Pulps, New York J. Dent., January, 1931; Disc. Reiss, H. L., and Furedi, Anna: D. Cosmos, 75:281-283 (March) 1933.

9. Raper, H. R.: Electro-Radiographic Diagnosis, St. Louis: C. V. Mosby Co., 1921.

10. Reiss, H. L., and Furedi, Anna: Significance of the Pulp Test as Revealed in Microscopic Study of Pulps of 130 Teeth, D. Cosmos, 75:272 (March) 1933.

we applied the rubber dam and made our tests, first moistening the teeth with saliva, and then another test was made, moistening the teeth with water. The results were virtually identical. We also noted that when the rubber dam was applied, the threshold throughout the mouth was slightly higher, but not sufficiently to make any difference in our observations.

Our findings definitely substantiate Reiss' work, and we also note that:

1. A variation for similar teeth in the same jaw is limited to a maximum of 20 volts, which is 20 per cent. Anything beyond this denotes pathosis. In Reiss' work, a variation of 30 volts, or 30 per cent, was obtained. We believe that such differences as in thickness of enamel, the presence of filling materials and other physical changes in the tooth structure can be accounted for in this variation.

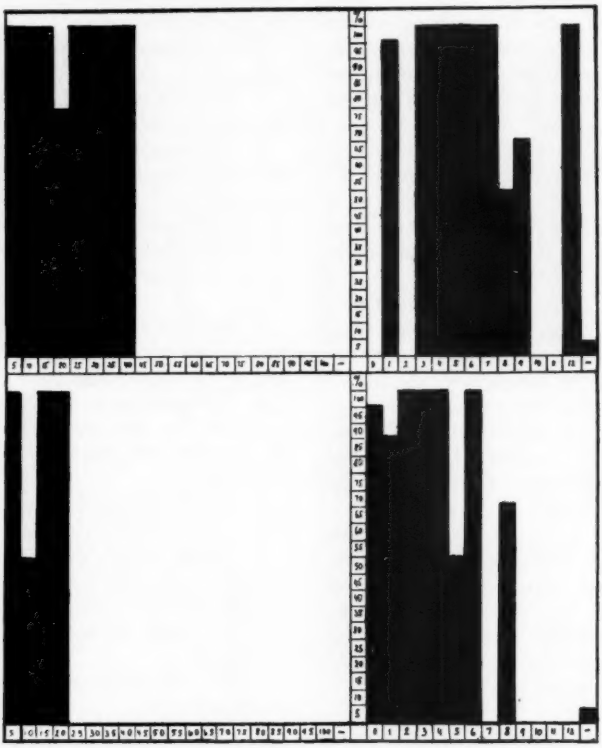

Fig. 2.—Incidence of normal pulps in incisors and cuspids. In Type I (above, left), practically 100 per cent of pulps respond up to 40 volts, and, beyond this range, there is no evidence of normal pulps. In Type II (above, right), practically 100 per cent of normal pulps respond up to 7, and beyond that point many of the teeth have normal pulps. In the Type I instrument (below, left), there were apparently no normal pulps beyond a variation of 20 volts. In the Type II instrument (below, right), the variation goes beyond 50 per cent of the scale.

It might be interesting to note at this time that Nunlist,[11] in 1931, called attention to the fact that teeth may still be normal and respond with a variation of 30 per cent from the control tooth. A variation greater than 30 per cent is strongly suggestive of pathosis. Unquestionably, our findings confirm his observation. Reiss noted that 90 per cent of the teeth which showed a greater variation were pathologic, in comparison to our 91 per cent.

2. An extremely high threshold or no response to maximum stimuli is evidence of necrosis of the pulp or other pathosis.

3. Reiss and Furedi have shown, and our findings concur, that most pathologic conditions can be detected in a quite reliable manner, the exception being marked atrophy. In this instance, the teeth usually have a normal threshold.

4. Although we feel that inflammatory changes are associated with abnormally low thresholds, which would correspond to the double plus findings of Reiss, we have not enough material at this time to draw any definite conclusions.

The accurate determination of the various stages of inflammation in dental pulps is an extremely important matter. Those pulps that show a more advanced inflammatory change are unquestionably associated with suppuration. In view of this, even though these teeth may give no clinical or roentgen-ray evidence of this condition, their pulps are undoubtedly possible foci of infection. Our own clinical observations at the present time would lead us to believe that, in acute pulpitis, with definite clinical symptoms, a tooth will have an abnormally low threshold. Those inflammatory conditions which show definite suppurative changes involving practically the entire pulp, without necessarily having clinical symptoms, will have an abnormally high threshold.

In addition to this study, we tested the same teeth with another type of instrument, and, in making the histologic studies of the pulps, we had available the pulp test findings of two types of instruments, which enabled us to make a comparative study of the diagnostic value of each. In selecting these types, we felt that we were employing those instruments which fundamentally represented the various mechanical and electrical principles used by most manufacturers for this purpose.

The instrument originally used by Reiss and which we briefly described previously, we shall refer to as Type I. In this instrument, the current passed from one electrode through the body to the other, apparently traveling through the long axis of the tooth. Further description of this instrument is not necessary, for one can obtain a detailed explanation in Reiss' article.

The other instrument involves a different principle and shall be referred to as Type II. For obvious reasons, I do not wish to use the trade names or manufacturers' names.

V. An-der-Lan,[12] in 1906-1907, first used the double or Wunschheim electrode for the tooth and thereby eliminated the hand electrode. In recent years, many of the modern instruments were constructed in accordance with this principle, and we have selected one of the most popular for our study. The current passes from one electrode to the other and only through the intervening tooth structure.

To begin with, the current used is in-

11. Nunlist, A.: Bemerkungen zur Vitalitätsprüfung der Pulpa nach Schroder, Schweitz, Monat. f. Zahnheilk., 1931, p. 784.

12. V. An-der-Lan, Othmar: Die Anwendung des elektrischen Stromes zur Diagnose verschiedener Pulpaerkrankungen, Vierteljahrsschr. f. Zahnheilk., 1907, p. 194.

duced by means of a solenoid. On the casing covering this, there are gradations from 1 to 12, with a sliding button which controls and denotes the approximate amount of current used. Connected with this induction apparatus is a rubber encased wire to which is attached the electrode. The electrode consists of a porcelain rod about 4 inches long and three-eighths inch in diameter, curved at the end, and in which are inserted two platinum pins, about one-fourth inch long and one-fourth inch apart. The current is applied by pressing a button on the induction apparatus. This is so constructed as to make and break the current about twenty times each time this switch is pushed in and released. No current passes through the electrode until the switch is engaged. One of the main faults of this instrument lies in the fact that the manufacturers have not been able to produce a switch that is absolutely noiseless, and, in some nervous patients, it is somewhat difficult to obtain an accurate response, for they very quickly realize that when

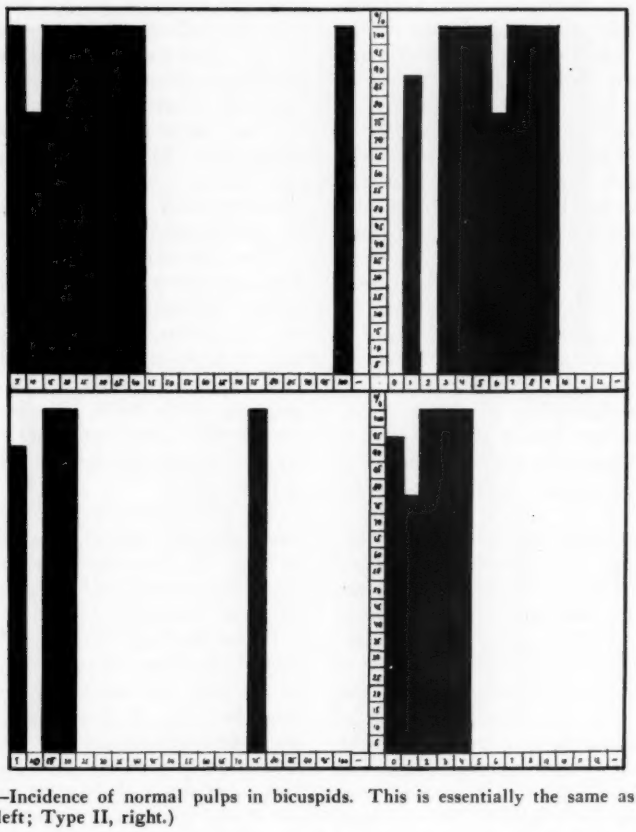

Fig. 3.—Incidence of normal pulps in bicuspids. This is essentially the same as Figure 2. (Type I, left; Type II, right.)

the switch is turned on, the current passes through the tooth. The same fault is found with the Type I instrument, wherein the electrode is charged at all times. An ideal arrangement would be one wherein the current could be applied without the knowledge of the patient.

The technic in the use of the Type II instrument was as follows: We always applied the smallest amount of current on each tooth and gradually increased the current until a definite response was noted. We routinely tested the mandibular incisors first, then the bicuspids and molars, and we followed the same procedure in the maxilla. We obtained the best results in testing the incisor teeth by placing both electrodes on the incisal edge wherever possible. When, for one reason or another, this was not feasible, the facial surfaces of these teeth were tested at about the gingival third, by trying to place one electrode on either the mesial or the distal surface. In this way, we obtained a much better contact. Occasionally, the lingual surfaces were tested. The cuspids were tested similarly. In bicuspids and molars, we used the sulci wherever possible. A second choice was the buccal surfaces. We placed the electrode on the enamel. When this was not practical, we placed one electrode on the enamel and the other on a filling, and usually obtained a response near the normal threshold. Care must be taken not to touch the soft tissues with the electrodes as the patient will receive quite a shock. Teeth should be moist when tested. The amount of moisture does not seem to affect the response. We found that if the patient was told to swallow and open the mouth, the proper amount of moisture usually covered the teeth.

The method of study included: 1. Complete clinical examination of the tooth and surrounding gum tissue. 2. Roentgen-ray examination. 3. Pulp test with two types of instruments. 4. Histologic examination of these pulps. 5. Notation of the age and any general systemic disorders.

The fact that a tooth responds to an electrical stimulus does not necessarily indicate that it has a normal pulp. It apparently denotes the presence of vital nerve fibers only.

We quote from the writings of Reiss and Furedi[10]:

> Of course we know that by means of the pulp tester we have only the response of the nerve as the indicator of the condition of the nerve but not of the pulp tissue, but, as our experience shows, secondarily one can conclude from the response of the nerve the condition of the pulp to a certain degree. Great difficulty arises from the fact that the vitality and the resistance of the pulp tissue and the nerve differ, the nerve being much more resistant to pathological affection and has much greater vital endurance. (Dr. Lester Cahn observed a similar phenomenon.) Thus certain pathological processes which result in the destruction of the pulp tissue without affecting the nerve will not be recognizable by a varied response.

Conducting our experiments as they did, we continued the study to differentiate the various responses of individual teeth in an attempt to determine the amount of current necessary to produce an abnormal response which would be significant of pathosis. For example, we know that a tooth responding with a certain instrument up to 40 volts of current will be regarded as one with a normal pulp. Any current in excess of 40 volts denotes pathosis. We further attempted to standardize these responses by a comparative study with the normal or control tooth. For example, we know that a tooth may still be normal and yet respond with a variation of 20 volts from the control tooth. A variation greater than 20 volts denotes pathosis.

We are assured by these previous observers that pulps may be normal and still show moderate atrophy, moderate degeneration and moderate degeneration and atrophy. Apparently, these microscopic variations that appear in so-called normal pulps are due to physiologic regressive changes. I wonder if, in certain cases, these changes are not a manifestation of some previous irritation, which has either been relieved or possibly is still existing. Clinically, these teeth are apparently normal.

Pathologic conditions that have been noted microscopically in our study included marked atrophy, marked atrophy and degeneration, inflammation, inflammation and degeneration, inflammation

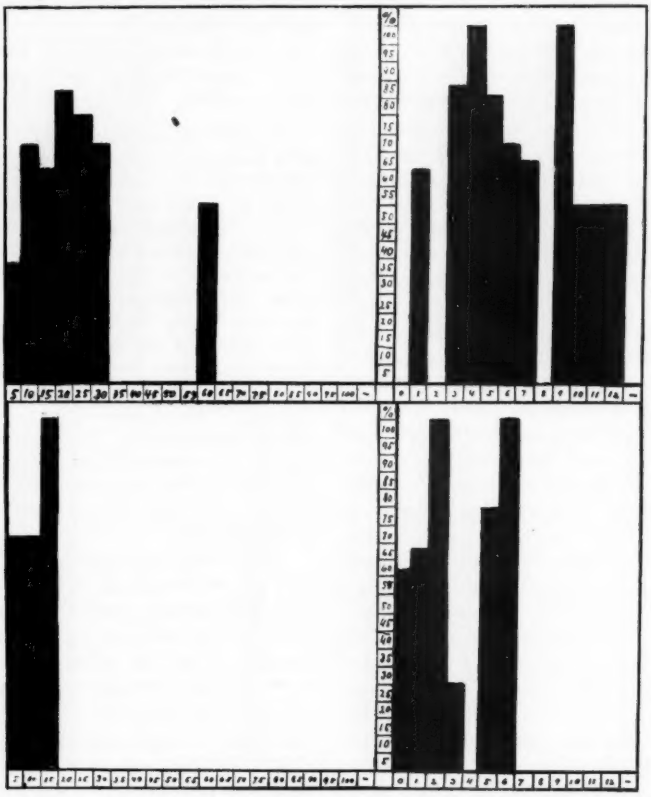

Fig. 4.—Incidence of normal pulps in molar teeth. Within a range of 40 volts, the incidence of normal pulps in molars was only 65 per cent on the Type I instrument (above, left). On the Type II instrument (above, right), the percentage, within normal range (1-7), was about 75 per cent, but normal pulps are also present throughout the remainder of the scale. In studying variations, normal pulps are noted with the Type I instrument (below, left) within a range of 20 volts, and with the Type II instrument (below, right), within a range of one-half the scale.

and necrosis, degeneration and necrosis and granulation tissue invasion.

In studying our charts of the comparative findings of the two instruments, up until the present time, we have come to the following conclusions:

1. A great majority of teeth responding from 1 to 7 on Type II instrument had normal pulps. In the remaining teeth which responded from 8 to 12, we found normal and pathologic pulps, and in no way were we able to classify the responses so that we might differentiate the normal from the pathologic in these higher thresholds. In Type I, pulps responding up to 40 volts were invariably normal. Those requiring a greater voltage were invariably pathologic.

2. Furthermore, in Type II, we were not able to obtain any reliable index in studying the variations between the affected tooth and the normal and its relation to the condition of the pulp. In Type I, when the affected tooth responded with a variation of more than 20 volts, the pulp was pathologic in virtually 100 per cent of the cases.

3. We also noted that teeth that did not respond to a maximum stimulus were 100 per cent necrotic with both instruments.

Obviously, therefore, even though Type II will show the presence of the vital nerve fibers, with a considerable degree of accuracy, it apparently does not reveal with any degree of reliability pathosis of the pulp. These findings were startling, for the profession had been led to believe that Type II, which was the modern instrument, was by far superior to any other, Type I being obsolete.

As neither instrument was 100 per cent accurate in determining the normal pulp, a further effort to account for our discrepancies was made and we decided to classify the teeth according to anatomic structure, grouping them as follows: (1) incisors and cuspids; (2) bicuspids, and (3) molars.

It was interesting to note that the greatest percentage of accuracy with both instruments was in the incisor and cuspid teeth. There was a slight discrepancy in the bicuspids; and, in the molar teeth, the discrepancy was greatest.

In using the pulp tester, one must always be on guard for possible errors. The most frequent causes of error are: (1) faulty technic; (2) the presence of multirooted teeth; (3) false reactions of the patient; (4) mechanical defects of the instrument; (5) with the Type I instrument, the presence of teeth with large metallic fillings in contact with adjacent teeth having large metallic fillings or crowns. These might give a questionable response; a condition which, of course, can be overcome by the use of rubber dam, and separation of the teeth.

Thus far, our findings permit us to summarize as follows: 1. We definitely substantiate those observations of Reiss and Furedi with the Type I instrument, thereby proving the reliability of the instrument and of the technic used in the hands of a careful operator.

2. Type II instrument denotes with precision the presence of vital and nonvital nerve fibers only.

3. With the Type II instrument, we have classified the responses from 1 to 7 on the indicator as the normal group. In detecting the presence of normal pulps, the comparative accuracy of the instruments is as follows: incisors, Type I instrument, 97 per cent; Type II instrument, 99 per cent; bicuspids, Type I instrument, 95 per cent; Type II instrument, 94 per cent; molars, Type I instrument, 65 per cent; Type II instrument, 76 per cent. We can therefore judge our responses in the various teeth accordingly. One must bear in mind the fact that a great percentage of teeth responding

from 8 to 12 on the Type II instrument are also normal.

4. The Type I instrument is reliable in determining pulp pathosis, being 91 per cent correct. Up to now, we have not been able to determine a method with the Type II instrument of detecting pulp pathosis, with the exception, of course, of necrotic pulps.

5. No response to an electrical stimulus with either instrument denotes a necrotic pulp.

If one will recall the history of pulp testing, it will be readily noted that, in practically thirty-three years, no apparent progress has been made. Our instruments are fundamentally the same and our findings are with few exceptions

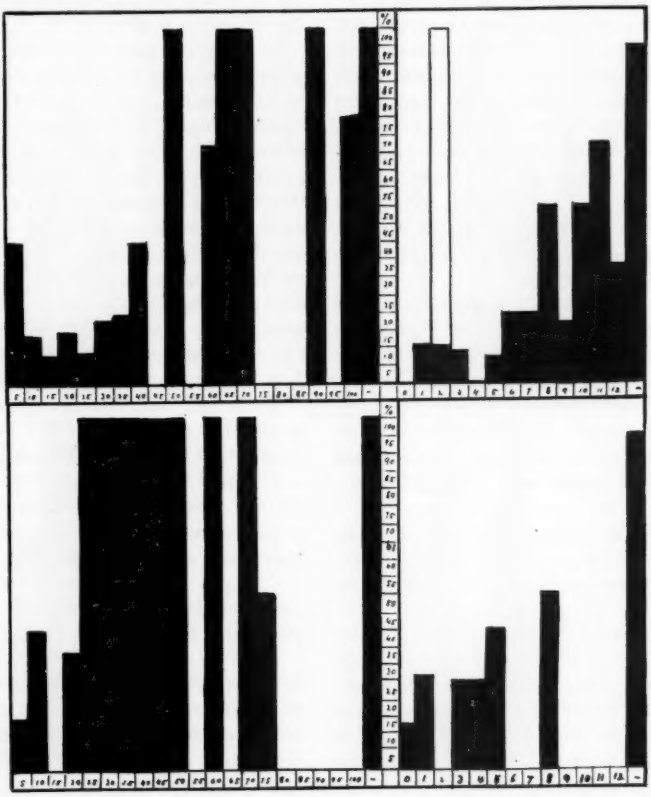

Fig. 5.—Presence of pathologic pulps for entire mouth. In the Type I instrument (above, left), almost 100 per cent of the cases requiring more than 40 volts evidence pathosis. In the Type II instrument (above, right), there is a slight tendency for the prevalence of pathosis in the higher thresholds. In studying the variations (below), it is noted that in practically 100 per cent of the cases, any variation greater than 20 volts designates pathosis, and with the Type II instrument (below, right) it is impossible to draw any definite conclusion.

practically identical. Unquestionably, this field should be explored more thoroughly in an attempt to determine whether the principles of pulp testing which we are using are theoretically correct or we actually have reached the limitations of our instrument.

It might be well at this time to note further some clinical observations associated with this work:

1. Children's teeth have a higher threshold.

2. In young persons, if the enamel is eroded or abraded, the threshold is lower.

3. In patients who are more advanced in years, and when there has been an opportunity for marked secondary dentin to be deposited and the organic material in the normal dentin has undergone marked calcific degeneration, the threshold is much higher. In those cases, application of the electrical current to the dentin will give a response at almost the maximum amount of current.

4. In teeth that are undergoing regulation, the threshold is considerably higher. It has a tendency to return to normal some time after the regulation has been stopped.

5. With the Type I instrument, in devitalized teeth with or without fillings, where there is an excess of moisture on the crown, a response is usually obtained, the current being conducted alongside the crown to the nerve fibers of the peridental membrane. In cases wherein moisture cannot readily be controlled or large metallic fillings are in contact interproximally, it might be well to use the rubber dam for isolation of these teeth.

In routine examination, the rubber dam is not absolutely essential, and its use does not materially affect the response and ultimate findings.

6. With the Type I instrument, we noted, in certain cases, that a response was felt at the hand electrode, especially in higher thresholds, and that these pulps were apparently pathologic.

7. In teeth that respond to a threshold slightly above or below normal, and in those that are sensitive to thermal or chemical changes, an earnest effort should be made to relieve the exciting cause, for we feel that the dental pulp may react similarly to other tissues of the body, and return to normal if again placed in a favorable environment. The response of the pulp tester could be used in determining this tendency.

8. In cases wherein there is an involvement through acute infection of the surrounding tissues, as in osteomyelitis, or in cases of trauma, either direct or as the result of surgical interference, those teeth that show abnormal responses at that time have a definite tendency to return to normal. This change can only be detected in its various stages by means of the pulp tester.

9. The instrument is an invaluable aid in determining operative procedure when it is to be decided whether teeth in close proximity to a lesion are involved.

10. It has been noted in the case of cementoma in the early stages that the pulp response is normal in spite of the presence of a radiolucent area on the roentgenogram. In this instance, the pulp test is evidently the only means of making a differential diagnosis between this lesion and the so-called apical granuloma.

11. Very often, it is the only means for making a differential diagnosis between a radicular cyst and a traumatic bone cyst, as first described by Theodor Blum.[13]

12. In cases of pulpotomy, the pulp test should be an important guide in determining which teeth are desirable for this operation. It might also render a reliable index as to the condition of these

13. Blum, Theodor: Unusual Bone Cavities in Mandible, J.A.D.A., 19:281 (Feb.) 1932.

pulps after the operation has been performed. This surely is a field for further investigation.

13. We quite agree with Reiss and others that the response of individuals to an electrical stimulus is a manifestation of the conditions of their reflexes. In routine examination of the dental arch, all normal teeth should respond to an electrical stimulus. The degree of intensity of this stimulus varies with different teeth in the same mouth. This variation is comparatively slight in the average case, and any response within a given range of electrical current is considered within normal limits. If, in routine examination, an occasional tooth does not respond within normal limits, the condition is evidently of local origin. If all the teeth in one or both arches give an abnormal response, there is apparently a systemic disturbance, and further medical investigation of the case is desirable.

A case was observed wherein the maximum amount of current applied to the teeth, which appeared normal on the roentgenogram, gave either a very slight response or none at all, but when several teeth were opened with a bur, the pulpal structures were found to be completely calcified. The patient was referred to his physician for a complete physical examination, and a diagnosis of Paget's disease was made. This ailment was contributory to his death several years later.

We have recently had occasion to make a pulp test in another case of Paget's disease, which apparently involved the maxilla and all the bones of the skull. The mandible was roentgenographically free from the disease. We noted that the teeth in the mandible had a normal threshold, and the teeth in the maxilla responded only to the maximum amount of current, and, in some cases, not at all.

Another case in which all teeth gave a negative response to the pulp test, and which had a past history of a gonorrheal infection, on physical examination showed a systemic condition affecting the entire nervous system. It is possible, in this instance, that there might also have been a syphilitic condition present. Unfortunately, a complete history could not be obtained.

In pulp testing the teeth of several patients who had psychopathic disorders, we noted no response or very little to maximum stimuli. We have also observed in those patients who are extremely nervous and "high strung" a much lower threshold.

I report two cases that will further demonstrate the importance of this means of diagnosis.

REPORT OF CASES

CASE 1.—In an emergency case, in a white woman, aged 37, it was found necessary to replant four teeth, which had been completely dislodged from the sockets two hours previously. Circumstances were such that there was no alternative to replacing the teeth without previously attempting root therapy. After several weeks, these teeth were pulp tested and found negative. Roentgenographically, they appeared normal. After a period of six months, the patient returned, and again after a negative roentgenographic report, another pulp test was made, and this time there was a slight response to the maximum stimulus. These teeth have been examined periodically ever since, and, at the present time, the upper right central and lateral incisors respond to normal stimulation, and the upper left central and lateral incisors give a definite response, but to a much greater amount of current.

In view of these findings, I feel justified in not disturbing the contents of these teeth. It is rather difficult to explain this response. I hardly believe that the nerve fibers have regenerated within the canal and pulp chamber. The response to the electrical stimulus can be produced by a

possible granulation tissue invasion or some other condition that we have not as yet been able to determine.

CASE 2.—In the case of a child, aged 12 years, a discoloration of the upper right central incisor was noted in the course of orthodontic treatment. The orthodontist referred this case for roentgen-ray and clinical examination in an attempt to ascertain the condition of the pulp. The roentgenogram was negative and the pulp gave a response only to the maximum stimulus. The control tooth and adjacent teeth responded at a normal threshold. In view of these findings, conservative treatment was suggested with periodic observations with the roentgen rays and pulp test examinations. Within a period of three months, the discoloration is gradually disappearing and, at the present time, the tooth has almost a normal appearance. With the return to normal color, there was a coincidental return to normal vitality on the pulp test, and, at the present time, this tooth responds within 5 volts of the corresponding or control tooth.

CONCLUSION

There is obviously a definite place for pulp testing in a diagnostic routine. The degree of accuracy of this test depends on the instrument used and the proper interpretation of the findings. No complete diagnosis of conditions of the oral cavity should be made without it.

Care must be taken in selecting an instrument for this purpose; for, strange as it may seem, the manufacturers and their representatives are not at all familiar with the actual diagnostic value of their instruments. This can be determined only by thorough scientific investigation, which unfortunately they have neglected to make.

The field for study of variations in the dental pulp and their precise detection should undoubtedly receive further exploration.

DISCUSSION

Daniel F. Lynch, Washington, D. C.: What pulp tester on the market allows one to know when the current is passing through the terminal ends into the tooth? It is all very well when we get a response from the tooth: We know the patient has received some current, but when we do not get a response, how can we be sure that a current is passing through the terminal ends? I know of no make of pulp tester that indicates this. There is one make on the market that makes a buzzing noise, but that in turn frightens the patient, just as the break on the switch does. I believe that I amply covered in the report the responses with the different types of instruments on non-vital teeth. Sometimes in teeth which roentgenographically appear to have root therapy we get a response with the Type I instrument. This is probably caused by the current being conducted alongside of the crown to the nerve fibers of the peridental membrane. This is usually associated with too much moisture. If one wants to check up on this point it is very simple to insert the rubber dam, dry the tooth well, and by taking a small moist wad of cotton and attaching it to the dental electrode another test is made on the enamel of the tooth. I am sure there will be no response.

Earle H. Thomas, Chicago, Ill.: The pulp tester is without value as a strictly scientific diagnostic instrument. From a practical standpoint, it aids us in guessing correctly possibly 98 per cent of the time as to whether a pulp is vital. This statement is made because many pulpless teeth with root canal fillings will respond to the tester and also because many vital teeth will not respond at all, especially those with large fillings and extensive deposits of secondary dentin. Because of these facts, all consultation reports are worded very carefully. We do not say that certain teeth are vital, but that they respond to a vitality test. The various degrees of response to a pulp tester mean nothing and are worthless from a diagnostic standpoint. On the many surfaces of any one tooth, one may, by moving the tester from one spot to an-

other, get varying degrees of response from a marked response to a minimum current to no response at all to the maximum current.

Dr. Kaletsky: One must take into consideration the variation and thickness of the enamel. The enamel is the only part of the tooth structure which offers a great deal of resistance to the passing of electrical current. I did not have an opportunity to bring that out. We feel that those different variations in response on the Type I instrument that I described can be accounted for within a range of 20 volts, and on the Type II instrument, that is, the double electrode, it cannot be explained satisfactorily.

Dr. Thomas: What about the other (Type II)?

Doctor Kaletsky: With the instrument I am reporting here, we did not receive a response with the maximum amount of current on non-vital teeth. As to the question of not receiving a response from vital teeth that can be accounted for in two ways: Either there was no current passing through the apparatus or else there was insufficient moisture on the crown of the tooth. In regard to Doctor Lynch's question about how we know when current passes in the two instruments: In the Type I instrument, there is a pilot light connected in series. If the current was interrupted for any reason this light would go out. In the Type II instrument when for no apparent reason a response was not obtained with the maximum amount of current we have always had the patient return for another test and in the meantime had the instrument checked for mechanical defect. This can be done very easily by applying the electrode to either the lip or the finger and a response is usually felt at a very low threshold if the apparatus is working properly. At the present time there is no other indicator on any instrument that I know which actually denotes the passage of current through the tooth.

Physiology of the Parathyroid—The parathyroid glands are concerned with calcium-phosphorus metabolism. Experimental work with animals indicates that calcium-phosphorus metabolism is of great importance in the body because it is necessary to the calcification of bone and teeth. The ionic calcium of the blood serum serves to control the varying normal degrees of irritability of nerve and of voluntary, as well as of involuntary, muscle. Because of this effect on the nerve endings and the involuntary muscle, it also increases vascular tone. It plays an important rôle in the clotting of blood and milk. That portion of the nonionized calcium which is diffusible may play its part with the ionized form in lessening the irritability of nerve endings and muscle. Contrary to popular opinion at the present time, little is known concerning these glands so essential to life; in fact, only recently the claim has been made that they are not essential, merely because parathyroidectomized animals are found to develop normally and to survive a complete reproductive cycle when given vitamin D. As complete parathyroidectomy is well nigh impracticable, these statements can be taken only as opinions probably lacking in the basis of demonstrable fact. . . . Hypoparathyroidism and hyperparathyroidism, while they do not strictly belong to a discussion of parathyroid physiology, are briefly mentioned, as it is from viewing the abnormal that one may draw probable conclusions concerning the normal. In parathyroid dysfunction due to a deficiency of calcium in the blood serum, varying degrees of hyperexcitability of nervous tissue and muscle may occur, the extreme degree being the clinical entity known as tetany. It has been estimated that 90 per cent of the convulsions in children under 2 years of age are due to this condition. Hyperparathyroidism, on the other hand, increases the viscosity of the blood and depletes the calcium of the osseous system. It may rightly be said that the normal function of the parathyroid is to preserve a normal nervous system and normal muscle contractility, including that of the heart, and to bring about and maintain the normal calcification of bone and the calcification of pathologic areas in healing processes.—Adolph M. Hanson, in *J.A.M.A.*, July 13, 1935.

The Journal of the American Dental Association

212 East Superior St., Chicago, Ill.

C. N. JOHNSON, Editor

NEWTON G. THOMAS, Associate Editor

Published by the American Dental Association

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Editorials

THE CURE

The cure to be suggested is not a panacea for all our dental ills, economic or otherwise, but at least it holds within it the germ of a solution of the problems of many of our members if they will only take it to heart and profit by it.

Men often marvel that they do not succeed better in practice, and they are always inclined to name any one of a hundred reasons for their failure, most of which are usually wide of the mark. Seldom does a man who fails look himself frankly in the face and recognize the fact that he alone is responsible, although, in one way or another, there is usually a personal reason for every failure.

Too frequently do men in practice ignore the real obligation of professional life when they come in contact with patients.

The moment a student reaches out his hand on graduation day to receive his diploma, he assumes a moral obligation that distinguishes him in an ethical way from a man engaged in a commercial

pursuit. It at once becomes his duty to devote his best energies to the service of humanity, and this means not a perfunctory or incidental service, but an intimate and vital devotion to the best interests of every person whom he serves.

When a patient enters a dental office for attention of any kind, he should at once be made to feel that this is a place set apart for his particular welfare. This relates not only to the care that is given the teeth and mouth, but also to the most solicitous attention to the comfort and convenience of the patient in every respect. The utmost consideration should be shown the patient and even his foibles and eccentricities should be humored to a certain degree; not, be it said, to the extent of placing in jeopardy the patient's welfare or the dentist's legitimate rights. The most perfect equity should always be maintained between patient and practitioner, and if there is a leaning in any direction, it should be toward favoring the patient rather than the practitioner. A dentist can afford to be generous in his dealing with the public. This does not mean that he need be subservient in any way, but that he should demonstrate kindliness of heart for all of those who are committed to his care.

Above all things, he should invariably seek to deliver the kind of professional service that will best conserve the welfare of the patient. A conscientious performance of every operation to safeguard the patient's health and comfort should be one of the cardinal tenets of the professional man's faith, and unless this can become an integral part of his every day conviction, he would better abandon dental practice and engage in some other pursuit. Slipshod methods of procedure inevitably lead to indifferent results, and nothing so saps the confidence of the people as the continued failure of dental operations. An occasional mistake leading to an occasional failure may be condoned on the ground that no one is perfect, but when failure becomes the established order of the day, the volume of dental service soon drops to the "irreducible minimum," and it is then that the profession so frequently complains that the people are not cooperative.

The simple fact is more and more apparent that unless the profession delivers satisfactory service to the people, the people will not patronize dentists more than they are actually obliged to, and

this is at least one reason that more dental service is not delivered. The treatment accorded the people by the profession regulates to a large degree the volume of service called for by the people, and this is something for every man and woman practicing dentistry to think about.

By this, no intimation is intended that superlative service should always be demanded of the practitioner. Dentists are human the same as are other members of society, and thus cannot be expected to perform miracles routinely in their work; yet it may be said in passing that a conscientious and capable dentist comes nearer to performing miracles every day of his life than almost any other professional man.

The cure then for most of our economic ills rests with the rank and file of the profession. The way to accomplish this cure is to bring the profession as a whole up to the standard of excellence displayed by the men who constitute the backbone of dentistry, and under whose egis the reputation of the profession is to be sustained.

The glorious possibilities of our profession were never more apparent than they are today. Dentistry has been recognized as an integral part of health service through recent legislation by many of our state assemblies, and particularly by the Supreme Court decision in the Oregon case. We are enjoying a constantly enhanced status as a medium of beneficent service, and all we need is an added sanctification of our ethical ideals, and a determination on the part of every member of the profession to so demean himself that in every contact with the people, they shall be made to feel that dentistry means not only added health security, but also the accompaniment of the most solicitous service.

It is confidently believed that this will go a long way toward solving our economic problems, and assuredly it will materially raise the esteem in which we are held by the public. After all, our reputation is in our own hands; it is up to us to keep the faith, and never to forget that as professional men and women we have an obligation to assume that transcends the ordinary obligations of life. We are the keepers at the gate, the guardians of the citadel and, to a very worthy degree, the conservers of human happiness.

WHY SALIVARY CALCULUS?

The statement has frequently been made that more teeth are lost from failure of the supporting structures of the teeth than from dental caries, and it has been claimed that at least one cause of injury to the supporting structures may be found in the irritation of calcareous deposits lodging on the tooth surfaces and encroaching on the soft tissues, eventually resulting in an absorption of the alveolar process and a consequent loosening of the teeth.

If this is a logical train of conditions leading to the loss of a relatively large number of the natural teeth, it would seem to be a rational question to ask, why so much calculus? Is it not time that some of our research workers delved a little deeper into the cause and manifestations of salivary calculus? There may be more significance than we suppose in the precipitation of the solid constituents of the saliva that leads to the deposition of calculus on the teeth.

Is it not possible that somewhere, and in some way in the alchemy of nature, there is a lack of balance in the physical economy of various persons whereby there is a failure to hold in solution the solid constituents of the body fluids with the consequent precipitation of the solids in the form of calculus? And if this is true, what agencies are at work bringing about this lack of balance? The simple fact is that long before this we should have learned more about the manifestations of the deposition of salivary calculus. Is it not possible that there may be some relationship between extensive salivary deposits and those remoter deposits in other parts of the body where they cannot be seen but where the results are more disastrous? Have any of our research workers tried to check up on the possible relation between the deposition of salivary calculus and the presence of stone in the kidney or in the gall ducts or the gallbladder? In diagnosing these major affections, would it not be possible for the diagnostician and surgeon to gain some light from the manifestations apparent in the mouth?

To go a step farther, why should we not be able eventually to ascertain the reason for calcareous deposits? By what process of law or order aré these lime salts (we are told that calculus is mostly

a lime deposit) precipitated from the fluids and lodged in various parts of the body? Why is this true in certain persons and not in others? And again, what is its significance?

This question is of sufficient importance to justify a more intimate study of the conditions that bring about the formation of calculus than we have ever had from our scientists, though attempts have from time to time been made to throw light on it. If we knew more about the chemistry of the body and the chemical processes that are constantly going on in the cycle of sustenance involved in digestion, assimilation and elimination, we might soon solve this baffling question of calculus formation, and, following this, it is quite conceivable that we should eventually be able to prevent the formation of calculus at will.

In any event, there is enough of promise in such a prospect to justify a serious effort on the part of our investigators, and the question is, who will undertake it? Here is an opportunity for some of our active and energetic young research workers to institute an investigation that will prove of concrete and lasting benefit to humanity and that will settle forever the baffling and age-old question, why salivary calculus?

ELEPHANTIASIS

In *Oral Hygiene,* August, 1935, the word "elephantiasis" is used figuratively to express overgrowth of the A.D.A. The overgrowth, pathologic, of course, is said to be manifested by "cliques, cabals and intra-associational societies." To one of the "intra-associational" societies, the author of the article calls attention, the American Association of Dental Editors. The proceedings of the fourth general meeting of that body were published in THE JOURNAL, April, 1935. Of these proceedings, he says, "It is a vicious attack upon the independent dental publications, one of dentistry's most honest and faithful servants."

As one reads the article, a question arises as to whether the author has read the report of the Commission on Journalism and the discussions that followed; a further question as to whether he has read

of the war waged by the A.M.A. for twenty-five years on patent medicines and quackery, and whether the Council on Dental Therapeutics and its program of examination and exposure are known to him. These questions arise in consideration of the fact that the American Association of Dental Editors is merely one factor in a movement that affects the whole of journalism, professional and proprietary. And the history involved seems so opinion-making and opinion-changing that a disinterested student of it could scarcely choose his position. Moreover, the author might have saved himself the mistakes that he made.

First of all, the organization that fostered the American Association of Dental Editors is not an intra-associational one at all: "extra" is the correct prefix; and while the American College of Dentists is made up primarily of members of the A.D.A., it is not an organic part of the A.D.A. Both the American Association of Dental Editors and the College may become inestimably important to the A.D.A. and stay apart, but whatever they do will be news to American dentistry. Next, says the author, "The reason," for the bitter criticism of the trade journals, "is, they are operated for profit." This statement too is in error. The reason is that profit is put first. It is as much the right of journals as of men to strive for profit, but if a professional man may not put profit first, how may a professional journal?

And it is because this emphasis on profit is so native to the privately owned or factory owned journal that it is slow to change. It is theoretically as easily possible for a trade house to publish an ethically sound journal as for an association to do so. Conceivably, an individual might do so, but history is to the contrary. The contention is, therefore, that since such journals call themselves by the name of the profession and thrive upon it, they should be willing to abide by the ethics and ideals of the profession. This, obviously they do not do; and more, they refuse to do so.

It is true, as the author contends, that some trade journals held the fort for dentistry when dentistry had no literary medium of its own. Also it is true that dentists establishing journals sought trade support in order for their journals to live. They accepted advertising of products that were far beneath their consideration as

aspiring benefactors of the profession. Trade journals in the main kept the records, published the concepts of the time, abetted the recording of professional history. The A.D.A. had not come, nor had the National Dental Association. Dentistry was a spread of scattered groups and more scattered individuals. Dentistry, today, in no quarter is ungrateful to the journals of those days, but the gratitude is tempered with the worldly wisdom that the publications were put out for the good of the firm. But, with the times, ideas have changed. How much, the records show. It is inevitable that the journals that serve a profession come to the requirements of the profession or be left to wither where they grew.

Of late, we have been calling ourselves by high sounding names. We are a "learned profession." We are of the "healing art." We are in "health service." All true enough, but while we said these things we had to keep our thumbs on our advertising pages, until recently. Then the A.D.A. shook off the old and put on the new. Alliance was made with the Bureau of Standards to save ourselves from deception and our patients from fraud. The Council on Dental Therapeutics was created to clear our pages of nostrums and quackery, false claims and false hopes. To be sure, there was profit in these wares, but dentistry was a health service and health service must be honest service.

In recent years, the proprietary school has gone, not because it could not be a good school, but because generally it was not. Honesty and worth in education flourish more normally in a university atmosphere; hence, the change. Proprietary drugs are going. They can't be depended on in a health service, and health servants can't well use them. So they wane. Proprietary journals underwrite themselves in similar terms and for precisely the same reasons. Journalism must keep in line with progress. Nearer to the truth, journalism should point the way of progress.

A proprietary editor said, "The handwriting is on the wall. We see it." But the journal he edits makes no change, issues no manifesto of a higher purpose than just profit. A nostrum was exposed by the appointed authorities of the A.D.A., the A.M.A. and the U.S.A., but still it is advertised by a dental trade journal. For what? By no stretch of words could one say for professional or

public benefit. And that journal is one of "dentistry's most honest and faithful servants!" An educated, an enlightened judgment has declared itself on the issue. If this generation can't see it, the one that toes our heels will.

There are some insidious effects that are overlooked by the professional men who defend the trade journals. They have been mentioned before and often. The motif of trade and profession are alien to each other. The two are not one and never can be. For the most part, such journals are given away, but none the less serve the purposes of the giver. If they did not, they would not be given. A gift obligates the man who accepts. From whom one accepts gifts, one may expect orders, nor can one object to infringements on his own domain. The seemingly free journal is not free, but its apparent freeness causes the beneficiary to lose his sense of responsibility. It saves him worry, work, cost, and makes him content with the "good enough." His sense of obligation to his profession and his professional organization is vitiated by a pseudo-charity. The trade journal, with its lag, its indifference to professional ideals, is the result of business acumen on the part of the owners and as much a result of dentists' indifference to general need. The journals of a profession form the continuation school of the profession, and hence should be the responsibility of the profession.

T.

PRACTICE IN PARAGRAPHS

This department is intended for busy readers. It aims to tell a vivid story in a few words. Items should be of a practical character, and free from padding—not more than a paragraph or two. We exact no limit, but two hundred words can tell most of these stories. Send in your ideas; they will be welcome.

Combination Fillings—A cavity in a large, deep, Class 1 molar cavity may be effectively filled with four different materials: 1. The tubules, with silver nitrate. 2. A cement base. 3. A nonshrinking copper amalgam lining. 4. Standardized amalgam. Combinations of filling materials often counteract shortcomings of individual materials.—*Herbert Ely Williams, Red Bank, N. J.*

Prophylaxis vs. Cleaning—Advising unnecessary prophylaxis semi-annually in compliance with custom is distinctly unfair to our patients. Better by far to apply an unnecessary prophylaxis fee to restorative work of permanent character, which

will reflect the dentist's ability and convince the patient that something has been accomplished of greater lasting value than cleaning unneeded.—*Herbert Ely Williams, Red Bank, N. J.*

The Aspirator—An efficient piece of equipment overlooked by most dentists is the suction or aspirator. It eliminates the use of sponges or swabs in surgical cases, giving a more rapid and clear view of the field of operation. The water pump type with reverse flow for cleaning will develop sufficient vacuum for most cases. This type is much less expensive than the motor driven. Various kinds of tips to suit the operator are obtainable.—*C. Bruce Suter, Rochester, New York.*

The Lost Art—An art must be found before it can be lost. It must be pursued to be possessed and retained. Many dentists opposed to the use of gold foil simply have lacked persistence to carry them past the opposition stage. The so-called lost art of gold foil is only a neglected art, lying dormant, awaiting revival. One gold filling a day may keep creditors away. This means 250 fillings a year; which would help the practice of any dentist complaining of hours unfilled.—*Herbert Ely Williams, Red Bank, N. J.*

The Dentist's Best Friend—In contributing to his patient's present and future welfare, the busy, sincere dentist and his chair assistant often fail to recognize minor office disorders. If patients were aware of the conscientious restorative efforts made in their behalf, they might overlook slight office irregularities. Unfortunately, the skill of many dentists is often judged by his housekeeping qualifications. The suggestions of some one akin whose honest criticism would be cheerfully accepted and carried out would be a tremendous help in office grooming. Such a person should be the dentist's best friend—his wife.—*Herbert Ely Williams, Red Bank, N. J.*

The Best Profession—A recently graduated dentist, fresh from two trips to the state board, remarked, "I studied dentistry because it takes longer for the laity to get wise to dentistry than to other professions." The constructive nature of material things, many unseen, makes dentistry a little different. Hidden cavities must not be overlooked or slighted. Patients who trust us to do what they cannot see themselves vest confidence in us to do it right. Conscientious dentists having varying interpretations as to needed fillings of fissures should explain fissure variations in an understandable way to trusting patients. If a dentist cannot be trusted to do what is right, he should not be trusted at all.—*Herbert Ely Williams, Red Bank, N. J.*

Prophylaxis of a Profession—"Salesmanship and buying" are words that leave a bad taste in the mouth of every ethical dentist. The dental profession is sorely in need of a commercial scrubbing. If commercialized words are in one's mind, they should be forgotten soon and substituted for at once with such words as "convincing of a need." Most patients are in actual need of dental care, but convincing them of that is something else. If one can be convinced regarding something he needs and can afford and is convinced of the wisdom of his selection of dentists, all barriers of opposition immediately and automatically break down. Commercialized words are harmful misfits in maintaining professional prophylaxis.—*Herbert Ely Williams, Red Bank, N. J.*

Profession vs. a Skilled Trade—When patients submit to a mastoid operation and do not question the surgeon's method of procedure, we have a recognition of medicine as a profession. When patients dictate to a dentist as to what he should do and how he should do it, we have a recognition of dentistry as a skilled trade. The world owes every ethical, conscientious dentist a living, and one must eat to live and live to carry on, but that does not mean that dental fees should be pushed down and compressed far below the level of the skilled trade wage. The time may come when the dental profession will have a greater degree of respect and a more dignified recognition. But as long as the "panelizing of a profession" socialized dentistry, dental and health insurance or other distinctly commercialized factors exist, filling the pages of dental literature, the time is quite remote.—*Herbert Ely Williams, Red Bank, N. J.*

Closing of the Antrum—The small opening of the antrum communicating with the oral cavity causes considerable annoyance and therefore should be closed. For this purpose, flaps are taken from either the palate or the alveolar mucosa. The flap must be made as large as possible in order that it may have an adequate blood supply, which prevents sloughing. The incision for making the palatal flap should be carried as far anteriorly as permissible, for thus cutting of the palatine artery, from which the blood supply comes to the tissue, will be prevented. In coapting the flaps, the edges and surfaces coming in contact should be freed of any epithelial covering and well scarified. The mucoperiosteal flaps ought to be separated from the bone, and contraincisions should be made to compensate the tension. It is necessary to take a sufficient number of sutures to prevent the separation and opening of the flaps.—*James L. Zemsky, 147 Fourth Avenue, New York City.*

Skimping vs. Plenty—"Just enough" welded gold foil is usually "just too little" when finishing time comes. Garments cut too short always stay too short, and in Class 5 cavities especially, "just enough" generally results in a flat finished filling, which is inartistic in appearance, yet often durable in reality. A flat gingival filling never looks right, because it is flatter than the tooth originally was, and, where conditions permit, plus full fillings are always preferable to minus flat fillings, even the patients themselves often observing the difference. Where nature has failed, underdoing must yield to man's overdoing. Gold-foil fillings in lower gingival cavities are invisible, until pleased patients pull down the lip to show the reason for their pride. Plus full, lower gingival cavities finished with a decided longitudinal ridge, convince the patient of an artistic effort and effect in a blended filling outline and tooth form. The contention that dentists must stress service rather than material things falls flat when material things go wrong themselves. Fair gingival gold foil fillings are representative of both materialistic purity and the most conscientious service. Skimping with gold foil proves that "just enough" in the condensation stage is generally just a little "too little" for the finishing stage, and short weight is one of the violations of the best traditions of the art of gold foil.—*Herbert Ely Williams, Red Bank, N. J.*

COUNCIL ON DENTAL THERAPEUTICS

JODO-FORMAGEN CEMENT—NOT ACCEPTABLE FOR A.D.R.

The Council has authorized publication of the following report.

SAMUEL M. GORDON, *Secretary.*

Jodo-Formagen Cement, put out by Gustav Scharmann, New York City, is advertised in dental journals as follows:

Don't Devitalize! Jodo-Formagen Saves MORE PULPS. For almost thirty years, thousands of dentists have used it successfully—not only to restore to health inflamed and exposed pulps, or to quiet hypersensitive dentine, but also *under all fillings,* as a preventive protection to the pulp against thermal changes and irritation.

Advertising circulars which accompany the product give similar information. The following appears therein:

What is Jodo-Formagen Cement? Of What Is It Made And What Will It Do?

The answer which follows, is:

The composition of Jodo-Formagen Cement is not a secret. It is a combination of Jodine Salts and Formaldehyde, with the addition of Eugenol Carbolic and Lysol to make a quickly hardening cement.

The statements which follow in the advertising further exploit the properties of formaldehyde, iodine and the phenols. Much is made in the advertisements and in communications from the firm of the recommendation of the product in the textbook, "Dental Pathology and Therapeutics," by Burchard and Inglis.

It is apparent that the foregoing statement of composition is essentially meaningless.

In 1928, an inquiry was sent to the firm requesting a qualitative and quantitative statement of composition. This inquiry was answered in an unsatisfactory manner and the reply was accompanied by the circular under discussion. This circular carries the following statements, among others:

Burchard & Inglis' Dental Pathology says: "At the present writing no other substance equals Formaldehyde as a pulp disinfectant because of its rapid diffusion through all canals, tubules or even abscess tracts. It is so efficacious in the writer's hands that it has replaced all other methods in his practice." So much for Formaldehyde as a germicide, an antiseptic and a disinfectant. It cannot be excelled. Unfortunately, used alone, it causes intense pain, even if greatly diluted. The Jodine Salts, the other component of the powder of the cement, dries up secretions and exercises a wonderfully beneficial and painless effect on granulation of the pulp. Carbolic Acid, the chief ingredient of the liquid of the cement, is a wonderful arrester of pain. It acts almost like magic. Eugenol and Lysol act along the same lines as the Carbolic. That's the combination of Jodo-Formagen Cement.

It is also stated to be:

An Unsurpassed Remedy for Inflamed or Exposed Pulps or Supersensitive Dentine.

Similar uninformative statements regarding the composition are given to dentists.

An examination of the statements made in Burchard and Inglis cannot be considered as acceptable evidence for the usefulness of the product for treatment of "deep seated caries, almost exposed pulp." A careful reading of the recommendations in the book does not reveal that it is more useful than zinc oxide and eugenol, which has long been used for similar purposes. The question of the success of pulp capping is not discussed. Ref-

erence to this has already been made in the report of the Council on Carbol Eugenol[1] but it is well known that attempts to cap pulps are not always accompanied by success. Hence the statement, "Don't Devitalize! You can save more pulps with Jodo-Formagen Cement" is unwarranted and misleading. There is, as far as the Council is aware, no acceptable evidence that Jodo-Formagen Cement is more useful for these purposes than zinc oxide and eugenol alone.

According to the examination made in the A.D.A. Bureau of Chemistry, appended below, it may be stated that despite the claims of the firm concerning the presence of iodine and formaldehyde, neither of these were found in the course of the chemical examination in either the powder or the liquid. This is of some importance in view of the circumstances that much of the advertising is built around the presence of these two ingredients.

According to the A.D.A. Bureau of Chemistry examination, the powder could be simulated by mixing together two parts by weight of zinc oxide and one part by weight of slaked lime; and the essential properties of the liquid could be simulated by mixing together 60 parts by weight of eugenol and 40 parts by weight of phenol. Compound solution of cresol was not found; hence, the claim that lysol is present may be questioned.

In view of the foregoing, Jodo-Formagen Cement (liquid and powder) is declared unacceptable for A.D.R.; i.e., because the product is secret in composition (Rule 1); tests for determining the composition of the product are not made available (Rule 2); the product is advertised with unwarranted therapeutic claims (Rule 6); the presence of potentially toxic substances is not declared (Rule 7); the name is misleading and does not indicate the important ingredients (Rule 8), and the composition appears to be unnecessarily complex, since it has not been established by carefully controlled evidence that Jodo-Formagen Cement will do more than zinc oxide and eugenol (Rule 10).

The report of the A.D.A. Bureau of Chemistry follows:

JODO-FORMAGEN CEMENT

Thirteen original packages of Jodo-Formagen Cement (Gustav Scharmann, New York City, price, $2.00 each, were purchased on the open market for examination.

The following appeared on the carton:

For painless capping of exposed and inflamed pulps and their preservation.

SPECIAL NOTICE: In cases where Jodo-Formagen Cement sets too quickly add a few drops of Oil of Cloves to the liquid. JODO-FORMAGEN CEMENT is not an oxyphosphate of zinc cement, it is a chemical preparation, and subject to atmospheric changes.

The following appeared on the enclosed circular:

Don't Devitalize! You can save more pulps with JODO-FORMAGEN CEMENT.

What is Jodo-Formagen Cement? Of what is it made and what will it do? The composition of Jodo-Formagen is not a secret. It is a combination of Jodine Salts and Formaldehyde, with the addition of Eugenol Carbolic and Lysol to make a quickly hardening cement. Unfortunately, used alone, it causes intense pain, even if greatly diluted. The Jodine Salts, the other component of the powder of the cement, dries up secretions and exercises a wonderfully beneficial and painless effect on granulation of the pulp. Carbolic Acid, the chief ingredient of the liquid of the cement, is a wonderful arrester of pain. It acts almost like magic. Eugenol and Lysol act along the same lines as the Carbolic. That's the combination of Jodo-Formagen Cement.

Each package contained a bottle of a white powder, a bottle of a straw-colored liquid, a small medicine dropper and a circular.

Powder.—Each package contained 4.6 gm. of a cream white odorless powder.

Qualitative tests indicated the presence of zinc, calcium and carbon dioxide. Phosphate, sulphate, anions precipitable with silver nitrate in nitric acid solution, silver, barium, sodium and potassium or organic matter were not found. An aqueous infusion of the

1. J.A.D.A., 21:1692 (Sept.) 1934.

powder gave an alkaline reaction to litmus. When it was heated in a closed tube, no organic matter appeared, nor was an odor of formaldehyde evident. The powder turned yellow on heating; which was suggestive of zinc oxide.

The suggestion is implied in the advertising that iodine salts are present in Jodo-Formagen. In view of the circumstance that anions precipitable by silver nitrate were not found, the following tests were carried out:

1. Five-tenths gram of Jodo-Formagen Powder was dissolved in 10 c.c. dilute nitric acid and 5 c.c. silver nitrate, test solution, was added. A slight turbidity but no precipitate appeared.

2. Five-tenths gram of Jodo-Formagen Powder was treated with 10 c.c. dilute sulphuric acid, boiled and filtered, and the filtrate cooled. To the filtrate, 5 drops of carbon tetrachloride and 1 c.c. of 10 per cent sodium nitrite was added and the tube shaken. A very faint pink appeared in the carbon tetrachloride layer.

3. Five-tenths gram of a powder made up of zinc oxide, chemically pure, 6.7 gm., calcium hydroxide, 3.3 gm., potassium iodide, 0.01 gm. (equivalent to 0.099 per cent potassium iodide) was treated as indicated in paragraph 2. A distinct violet color appeared in the carbon tetrachloride layer.

4. Twenty-five hundredths gram of the prepared powder was treated as in paragraph 2. There resulted a very faint pink, as in paragraph 2.

Quantitative determinations yielded the following:

Ash 900 C.	91.24 per cent
Sulphated ash	191.76 per cent
Zinc as ZnO	66.46 per cent
Calcium (Ca^{++})	16.90 per cent
Carbon dioxide (CO_2)	2.12 per cent
Alkalinity as $Ca(OH)_2$	27.73 per cent

From the foregoing, the following may be calculated:

Zinc oxide	66.5 per cent
Calcium carbonate	4.8 per cent
Calcium hydroxide	27.7 per cent
Undetermined	1.0 per cent

From the foregoing, it may be concluded that a product having the essential properties of Jodo-Formagen Powder may be made by mixing together, by weight:

Zinc oxide	2 parts
Slaked lime	1 part

Liquid.—Each bottle contained 4.3 c.c. of a light, straw-colored, refractive liquid possessing a predominating odor of eugenol with a faint odor of phenol (C_6H_5OH). The odor of cresol or of formaldehyde was not apparent.

The specific gravity was 1.055 (25 C/25 C) and the refractive index was 1.5360.

Ten cubic centimeters was transferred to a 25 c.c. distilling flask and distilled. The following fractions were obtained:

-210 C.	1.4 c.c.
210-238 C.	1.9 c.c.
238-255 C.	6.0 c.c.
Residue to make	10.0 c.c.

The first two fractions on standing partially solidified, yielding needle like crystals. The crystals were separated and dried on filter paper, then on a porous tile. They possessed an odor of phenol (C_6H_5OH). When dissolved in water and treated with ferric chloride, test solution, a purple was obtained. They melted at 38-40 C. A small portion was treated by the method described in "Identification of Pure Organic Compounds."[2] The yellow crystals obtained melted at 121.8 C., and when they were mixed

2. Mulliken, S. P.: Identification of Pure Organic Compounds, Vol. 1, p. 108, T. 414-2, New York City: John Wiley & Sons, Inc.

with an authentic specimen of picric acid, no depression in melting point was observed.

The fraction boiling at 238-255 C. had an odor of eugenol.

Steam distillation of 10 c.c. yielded 6 c.c. of a distillate with a pronounced odor of eugenol. The aqueous distillate yielded a negative test for formaldehyde with fuchsin and with phenylhydrazine hydrochloride.[3]

In view of the assertion that there is formaldehyde in Jodo-Formagen and the negative test above described, a more refined test was applied to the liquid. Two cubic centimeters of Jodo-Formagen Liquid was transferred by a pipet to a 300 c.c. distilling flask, arranged for upright distillation, and 75 c.c. of water and 2 c.c. of glacial phosphoric acid were added and the mixture was allowed to stand over night. The mixture was slowly distilled until about 50 c.c. was collected. After the oily and aqueous layers had completely separated, the lower layer was drawn off. The aqueous layer was filtered into a 50 c.c. volumetric flask and brought to volume by addition of water.

The liquid was tested for formaldehyde by the potassium ferricyanide test suggested by H. J. Fisher in "Examination of Composition Tumblers with Reference to Possible Liberation of Formaldehyde."[4]

By comparison with known amounts of formaldehyde, the test gives a quantitative estimate of the amount present. The test is carried out as follows: Three solutions are required: (1) 2.5 gm./100 c.c. phenylhydrazine hydrochloride; (2) 8 gm./100 c.c. potassium ferricyanide; (3) 10 per cent solution hydroxide. Five cubic centimeters of the solution to be tested are pipetted into a tube. To the tube, 3 drops of reagent 1 are added, mixed, 2 drops of reagent 2 added, mixed, and allowed to stand for a few seconds. Eight drops of reagent 3 are then added, mixed, and the color which develops is compared with known amounts of formaldehyde treated similarly. The following was noted:

1. Five cubic centimeters of solution formaldehyde, 1:1000, yields a deep red.
2. Five cubic centimeters of solution formaldehyde, 1:1,000,000 (0.1 c.c. 1:1000 solution diluted to 100 c.c.) yields a decided rose color, approximately R.O. Tint 1 on Mulliken's charts.
3. Five cubic centimeters of distillate from Jodo-Formagen yields just barely a trace of pink, approximately O.Y normal tint on Mulliken's charts, from which it may be concluded that formaldehyde in amounts approximating 1:1,000,000 was not found.

Iodine compounds were not found.

Methoxyl Content: As no method appeared to be available for the direct quantitative separation or estimation of phenol and eugenol which were found in Jodo-Formagen Liquid, the percentage of methoxyl (OCH_3) which indirectly yields an estimate of the eugenol present was determined by Zeissel's method. The apparatus and method described by Phillips[5] were used. Phenol was not added and pyridine was used to absorb the formed methyl iodide. The iodide was determined volumetrically. Two gas washing bottles were used: the first contained concentrated sulphuric acid, the second silver nitrate.

The following results were obtained:

Jodo-Formagen Gm.	0.1 $NAgNO_3$ Required c.c.	Per Cent OCH_3	Per Cent Eugenol
0.4786	17.19	11.15	58.98
0.4626	16.56	11.11	58.78

From the distillation data and from the methoxyl data, it may be concluded that a

3. Official Methods of the A.O.A.C., Ed. 3, p. 340, xxxii.

4. Bull. 354, Conn. Agr. Exper. Station, July, 1933.

5. Phillips, M.: Quantitative Determination of Methoxyl, Lignin and Cellulose in Plant Materials, J. A. Offic. Agric. Chemists, February, 1932, p. 119.

product composed of 60 parts by weight of eugenol and 40 parts by weight of phenol would have properties essentially similar to those of Jodo-Formagen liquid.

Subsequent to the examination recorded above, a new piece of advertising for Jodo-Formagen Cement was received. The following appeared therein:

The powder is a combination of formaldehyde and iodine salts and the liquid consists of eugenol, carbolic acid and lysol.

Accordingly, it was felt desirable to examine the powder for the presence of formaldehyde or formaldehyde-like compounds.

One gram of Jodo-Formagen Cement Powder was shaken with 10 c.c. of water and allowed to stand for one hour. The liquid was filtered from the insoluble powder and the residue washed with water until the filtrate measured 10 c.c. Portions were examined for formaldehyde by the tests described in "Official and Tentative Methods of Analysis of the Association of Official Agricultural Chemists."[6]

To 5 c.c. of the filtrate, 0.03 gm. of phenylhydrazine hydrochloride and 4 drops of a 1 per cent ferric chloride solution were added. The liquid was cooled in a bath of cold water, and 1 c.c. of sulphuric acid added. The liquid was colorless. The presence of formaldehyde is indicated by the development of a red color and the test is slated to be reliable for from 1 part in 50,000 to 1 part in 150,000.

To 5 c.c. of the filtrate was added a lump of phenylhydrazine hydrochloride the size of a pea and 4 drops of freshly prepared 5 per cent solution of potassium ferricyanide and 10 drops of a 10 per cent solution of sodium hydroxide. No apparent change in color was produced. If formaldehyde is present to the extent of 1 part in 70,000 to 80,000 in the solution under test, a distinct green or bluish green should be obtained.

From the foregoing, it is concluded that formaldehyde is not present.

TOPICAL ANESTHETICS WITH REFERENCE TO SALIGENIN

The Council has authorized publication of the following report.

SAMUEL M. GORDON, *Secretary.*

Requests frequently come to the Council for information on topical anesthetics to be used prior to insertion of the needle, or for the relief of local pain following the exposure of the alveolar process after extraction or the surgical removal of teeth. The inquiries are, as a rule, for a "good" topical anesthetic to be used prior to insertion of the needle.

These requests relate particularly to the composition of the many proprietary brands, exorbitantly priced and extravagantly advertised. Most of these contain ethyl aminobenzoate, U.S.P. (benzocaine) as the principal ingredient, and the claims for none of them appear to be supported by laboratory or clinical evidence. The inability of benzocaine to penetrate the intact mucous membrane is well known. Its use for relieving pain when the tissues are broken is equally well known. On this account, the use of ethyl aminobenzoate and cogenors (orthoform, butesin) is limited to wounded and open surfaces. No evidence has been made available that these secret and expensive preparations will do more than will a 10 per cent solution of benzocaine, which is the concentration suggested in A.D.R. Desensitization of the intact mucous membrane by agents which act on the terminal nerve endings is not readily accomplished.

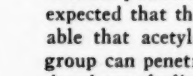
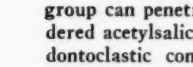
The referee is aware of two studies which are being made at the present time and

6. Ed. 3, pp. 340, 341, paragraphs 18 and 22, respectively.

which show the inability of most agents to cause enough anesthesia to overcome the prick of the needle point. These results seem to justify the conservative position on these products expressed in A.D.R.

To disregard for the moment the limited penetration of local anesthetic agents through the gums, the use of the following is more or less feasible: cocaine, benzyl alcohol, butyn and tutocaine. These compounds are amply described in accepted books of standards.

In the course of its work, the Council has considered and found not acceptable a paste the principal ingredients of which were acetylsalicylic acid and orthoform; marketed for the relief of postoperative pain after extraction. The product was held not acceptable on various points, but the referee particularly stressed the fact that a mixture of acetylsalicylic acid and orthoform in ointment form was more useful than orthoform alone, the use of which for this purpose was long recognized. The referee was not unaware of the various investigations that had been conducted on the salicyl group of compounds that might have some bearing on the practical application of this group of drugs for local analgesic purposes in dentistry.

The purpose of this report is to consider the status of related products for the information of the dental profession. While there is no direct evidence of the local anesthetic action of acetylsalicylic acid available in the medical literature, there is evidence that the salicyl group can penetrate cell surfaces and cause protoplasmic depression. Free salicylic acid () has been shown to exert a local anesthetic action on frog skin (mucosa). As it is generally conceded that the acetylsalicyl group () is more powerful as a central nerve depressant than is the ordinary salicylate, it may be expected that the local tissue and cellular depressions also would be greater. It is probable that acetylsalicylic acid can penetrate nerve trunks and endings, since the salicyl group can penetrate the skin and oral mucosa. Barkann[1] has suggested the use of powdered acetylsalicylic acid rubbed into the gums prior to instrumentation for certain periodontoclastic conditions. The "anodyne paste dressing" suggested for the National Formulary VI contains about 25 per cent of acetylsalicylic acid.

If a member of the salicyl group of drugs is to be chosen for local analgesic and topical anesthesia, the use of saligenin seems to be more to the point than use of acetylsalicylic acid or free salicylic acid. The local anesthetic action of saligenin has been well established by both experimental and clinical results.[2] For present purposes, it is important to note that weak solutions were found relatively ineffective when applied to intact mucous membrane, while strong solutions (12 per cent) exerted a definite numbing effect.

The following citations from the literature indicate the nature of the evidence for the protoplasmic action for the salicyl group in general: penetration and decrease of motility in cilia caused by sodium salicylate[3]; respiratory inhibition of avian erythrocytes[4]; absorption of sodium salicylate from the oral mucosa of rabbits, salicyl appearing in urine in twenty-five minutes[5]; depression of frog's heart by contractions of salicyl found in the blood of a person taking therapeutic doses of acetylsalicylic acid, and hemolysis of cor-

1. Barkann, Lillian: New Painless Treatment in Periodontal Disease, D. Cosmos, 73:674 (July) 1931.
2. Hirschfelder, A. D.; Lunholm, A., and Norrgard, H.: J. Phar. & Exper. Therap., 15:261 (June) 1920.
3. Jucci: Arch. sc. biol., 16:71, 1931.
4. Raab, E.: Arch. f. d. ges. Physiol., 217:124, 1927.
5. Blume, W., and Buchholz, G.: Arch. f. exper. Path. u. Pharmakol., 166:472, 1932.

puscles caused by intravenous injection of acetylsalicylic acid, 1:1430 concentration[6]; absorption from rabbit skin of acetylsalicylic acid in different bases, the minimum amount yielding detectable salicyl in urine being 0.03 gm.,[7] and complete local anesthesia to pinch or pressure stimulus of frog's foot (mucosa) immersed in 0.07 per cent salicylic acid.[8] On the other hand, Kondo[9] asserts that the direct application of free salicylic acid to the exposed pulp of a rabbit's tooth did not allay the pain of direct electrical stimulation. But this is a rather severe test of nerve irritability.

From this discussion, it seems clear that the salicyl group, in general, is capable of causing a depression of sensory nerve endings, and it is possible that such an action would be greater with the acetylsalicyl group. There also seems to be no question that both groups can penetrate cells and tissues, and here again the acetylsalicyl group may be more efficient than the ordinary salicyl. There are objections to the use of acetylsalicylic acid owing to idiosyncrasies and variations in individual sensitivity, and there is no reason to believe that the salicyl and acetylsalicyl groups would be in any way superior to saligenin as a local anodyne or anesthetic. As already pointed out, the local actions of this salicyl alcohol are well established, although it has not superseded procaine, for well-established reasons. The referee is of the opinion that there is a legitimate demand for topical anesthetics in dentistry and the properties of saligenin appear to be such as to warrant further experimentation with it by members of the dental profession.

Accordingly, the Council lists for information the following monograph on saligenin for inclusion in A.D.R.

Saligenin.—Saligeninum.—Salicyl Alcohol.—o-Hydroxybenzyl Alcohol.—1:2-Phenolmethylol.—$C_6H_4(OH)CH_2OH$.

PROPERTIES: Saligenin occurs in white rhombohedral plates or as a white crystalline powder, permanent in air; faintly aromatic odor; tastes slightly burning, a sense of numbness following. Saligenin is soluble in water and chloroform; freely soluble in alcohol and ether; also soluble in fixed and volatile oils.

ACTIONS AND USES: Saligenin is a local anesthetic similar in action to procaine hydrochloride. It is said to be as effective as the latter, but much less toxic; also the anesthesia produced lasts longer and for this reason the addition of epinephrine is not necessary. Weak solutions are relatively ineffective when applied to intact mucous membranes, but strong solutions (12 per cent) exert a definite numbing effect.

DOSAGE: The same as that of procaine hydrochloride for infiltration anesthesia. In ointment form, 10 per cent in lanolin or petrolatum is suggested.

Saligenin was first described by Piria (Ann. Chem. Pharm., 56:37, 1845), who obtained it by action of emulsin on salicin. The pharmacologic properties and therapeutic applications of saligenin were investigated by Hirschfelder and his collaborators (J. Pharmacol. & Exper. Therap. 15:261, 1920), who reported that it was many times less toxic than the other local anesthetics studied and that it was well suited for use in practical surgery.

6. Simon, Italo: Arch. di farmacol. sper., 55:151 (April 1) 1933.
7. Kionka, H.: Klin. Wchnschr., 10:1570 (Aug. 22) 1931.
8. Tagaji: Folia Pharmacol. Japon., 1:15, 1925.
9. Kondo: Jap. Med. Sc., 5:75, 1930.

BUREAU OF PUBLIC RELATIONS

PROPHYLACTIC CARE OF THE CHILD'S MOUTH*

By CELIA RICH, D.D.S., Nashville, Tenn.

THE confidence reposed in the wisdom and beneficence of nature is to a great extent justifiable, but it contains certain devastating possibilities. With the discovery of every oil well, we have permitted uncontrolled pumping, in the faith that when it is exhausted, another will be found. With the development of every rich coal field, we have encouraged rapid extraction of the mineral, with no thought but that another will be readily provided when this is depleted. Our vast forests we have ruthlessly despoiled and the failure to give heed to their preservation has resulted in floods, now practically uncontrollable.

Recognition of the danger inherent in such a policy has inspired the new national economic conservation program. "We are saved by making the future present to ourselves" and "To divine the future we should study the past." Our country now sees the fallacy of neglecting or squandering its natural resources and is roused to the immediate necessity for preventive measures.

The medical profession in all its branches long ago saw the importance of such a policy, and dentistry has come to realize more and more that without some systematized method of prevention, the profession is utterly unable to cope with dental and oral defects incident to present-day civilization. We know that once caries has advanced to any considerable extent, its effects are irremediably and permanently injurious—that when gingivitis has progressed to a pronounced periodontoclasia, the mouth is irretrievably damaged as to both comfort and function and that after a child has passed the growth period with deformed arches and malposed teeth, the facial contour may never be restored to its best possible appearance nor the accessory sinuses and cavities to their maximum functional proportions; that, in short, by the time the patient has reached maturity, many undesirable conditions have become irrevocably established in the mouth.

While it is true that certain types of oral disease belong essentially to mature life, the majority of dental diseases and perhaps the beginnings of all are to be found with greater or less frequency in the child's mouth. Gingivitis and deeper periodontal inflammation are not unusual. Malformation of jaws and malarrangement of teeth are so usual as to be almost a rule, while caries, with its sequelae, which constitutes by far the most frequent of dental diseases and perhaps the most widespread of all juvenile diseases, manifests itself often almost with the appearance of a tooth through the gum.

Recognition of these facts has brought children's dentistry prominently to the

*Read before the Section on Preventive Dentistry, Children's Dentistry and Mouth Hygiene at the Seventieth Annual Midwinter Clinic of the Chicago Dental Society, March 1, 1934.

fore in recent years. The Society for the Promotion of Dentistry for Children is an evidence of the interest in this branch of dentistry, as well as a spur to further efforts along the same line. The establishment of many philanthropic foundations for the care of children's teeth in recent years further attests the important place which the care of children's teeth has come to occupy: foundations such as Col. George Salmond's, in Providence, R. I.; the Forsythe Brothers', in Boston; Senator Cousen's, in Detroit; DeLos Hill's, in Atlanta; Howard Lowry's, in Kansas City; George Eastman's many clinics, all over the world; the Murray and Leonie Guggenheim Clinic, in New York City; Mrs. Montgomery Ward's, in Chicago, and Mrs. George Carter's, in Hawaii.

The national survey of the teeth of the school children of the country is a further effort along this line.

The more earnestly we try to cope with the problem of caring for the teeth as we find them, the firmer our conviction becomes that our best hope lies in preventive or control measures for the child—in so-called oral prophylaxis, which has been well defined (by Spalding) as "that scientific effort, educational, operative or therapeutic, which tends to prevent disease (or abnormalities) of the teeth and periodontium"; prophylaxis, which taken literally means "to keep guard before."

Guerini, in his "History of Dentistry," credits Hippocrates with saying, "Diseases should be combated in their origin," and elsewhere the great father of medicine is quoted as saying (in "de Carnibus"), "The first teeth are formed by the nourishment of the fetus in the womb and after birth by the mother's milk. Those that come after these are shed are formed by food and drink." This was more than 2,200 years ago, and without going deeply into the subject of embryology, it is interesting to note the confirmation of this finding in all recent research on human specimens. Orban has shown tooth germs of deciduous incisors present in the embryo at 92 days. At 100 days, the dental papilla already has the shape of the future crown of the tooth and the bud for the first permanent molar has appeared, while sections of teeth of a 164-day-old embryo show dentin depositing and a thin layer of enamel already present.

It would thus seem that the condition of the expectant mother would be the first concern in oral prophylaxis for the child. No specific diet for the mother can be considered to be directly beneficial to the teeth of the developing fetus. According to many if not most medical authorities, the fetus is very much of a parasite and will somehow get the materials necessary for the growth of its flesh, bones and teeth from the mother even if the mother's tissues and reserves are drained and damaged. The unborn child will not suffer, we are told, unless the mother's diet is pushed practically to the starvation point.

The most that can be said with certainty at present is that proper diet, sunshine, etc., does influence the mother in the direction of favorable mineral balances, and "It is conceivable" Schlutz says, "that these effects may be so far reaching as to affect the development of the dental structures of the fetus and influence their characteristics in later life." He concedes that much experimental work still needs to be done before even this connection can be considered proved. Apparently, then, the importance of the diet of an expectant mother in the child's dental welfare is principally indirect in that any injury to the mother's health and efficiency will of course be detrimental to her care of her child.

The case is different during lactation, when it is the nursling who suffers most injury if the mother is not supplied with sufficient and proper food.

When a pregnant woman comes in for treatment, it is our invariable custom, after looking to her immediate needs, to ask whether she is under the care of an obstetrician. If she has chosen a progressive specialist, we can be reasonably sure that she has been advised as to a correct régime of hygiene: proper rest, fresh air, sunshine, exercise and diet. We still can inquire into these matters, and if the diet is deficient in any important respect, i.e., in foods such as dairy products, fresh fruits and vegetables, meat, fresh butter and eggs, foods which are rich in the essential minerals and which, with the addition of plenty of unobstructed sunshine, supply a sufficient quantity of the vitamins A, C and D, we can tactfully suggest that she ask her physician what he thinks of them and when he does not rise to the occasion, do our feeble best in his stead.

Sometimes, the dentist sees these patients before an obstetrician has been consulted, and it may seem to be necessary that he give specific advice concerning diet, etc. The best service that we can render in these cases for the unborn child as well as the mother is to persuade her to put herself in the hands of a conscientious obstetrician if possible; or, at least, consultation and cooperation of the physician should be sought. He will watch not only such things as calcium intake and utilization, but also the weight, urine, blood-pressure, etc.

The general well-being of the mother usually gives the best chance for the normal development of the baby from its teeth to its toes.

The public health centers and clinics, the Red Cross and similar agencies now cover a large part of the country and are reaching more and more people and furnishing reliable data on prenatal care to mothers who never see a dentist during this period. The same agencies are instructing parents as to diet and general care of infants, which is of even greater importance to tooth building. The moving pictures and radio broadcasts give valuable information, and it is not too much to hope to see better teeth eventually as a result of the cooperation of these agencies.

Assuming that the mother has had a scientifically correct régime and her baby good care and a well-ordered diet, we may reasonably expect to find twenty teeth in place and in good alinement by the time the child is 2½ years old.

If the mother is herself receiving regular dental care, she should also have been getting information from her dentist concerning her baby's mouth. She has been told that before the teeth erupt, the baby's mouth had best be left untouched as the chances of harm from possible abrasions produced in attempting to cleanse it overbalance any very doubtful benefit that might come from such cleansing. There has been more general talk between her and her dentist of hygiene and diet and the early beginning of tooth development. A small brush, not too soft, with bristles well spaced, is sent the baby when the deciduous molars erupt, to be used the first thing in the morning and after each meal. We seldom see the child before he is 3½ or 4 years old. Three would be the ideal time, or as soon as the second deciduous molars are in place.

The first meeting between dentist and patient takes place in the reception room and is largely a matter of getting acquainted, but, after a few preliminaries, it is usually a simple matter to make a cursory mirror examination. If the mouth appears to be in perfect condition, so much the better. Such an examination

is the best possible prelude to more exacting treatment, which may have to be instituted later. Exceptional care should be taken to avoid anything of an unpleasant nature on these early visits.

The careful examination of the mouth is one of the most important procedures in preventive dentistry, whether of the infant's mouth, the school child's or the adult's. Too often, the mistake is made of examining only the teeth themselves. This, of course, must be carefully done, but much significant information is obtained by noticing the color and general appearance of the mucous membrane of the gingivae, cheeks and tongue. The first signs of systemic disorder are sometimes manifested in the mouth, and these signs should be recognized and attention called to them. If necessary, the case should be referred to a competent pediatrician. The arrangement and occlusion of the teeth should be noted and any irregularity or abnormality inquired into, with a view to discovery of its etiology and "combating the condition at its source."

Later on, when the child reaches school age, important new factors must be dealt with. The period from a child's entrance into school until all the deciduous teeth are lost and their successors are in place is particularly difficult from the standpoint of maintaining a healthy local condition. Outside influences are coming into play. Sometimes, a considerable nervous strain results from the unaccustomed routine and confinement. There are school lunches, with nickels to spend for candy on the way home. In the boy especially, there is often manifested an insouciance such as is exemplified in the youngster who lets his trouser leg hang half way down and whose shirt is never tucked in, who resents having his ears inspected, but fails to wash them carefully himself. He scorns to brush his teeth except once in a while. As a matter of fact, children at this age are so full of energy that when night comes, it is but natural for them to be too tired to brush their teeth before going to bed. Moreover, the loosening of the deciduous teeth and the eruption of the successors makes brushing difficult.

It is fortunate indeed that at this time the school dental clinic and dental nurse begin to function. As part of the school routine, the child gets periodic dental examination, and no questions asked. The treatment needed may be given by the school dentist, or in a private office, but the psychologic value of making dental attention part of the regular school program can hardly be overestimated. Instruction received in a group with his fellows in school impresses the child as nothing else will at this age.

Right here, I wish to emphasize the importance of the dental hygienist in this educational work. She is especially trained not only in the fundamentals of the care of the teeth, but in teaching and speech making as well, and, in the majority of cases, develops a personality and a technic for this sort of work which enables her to put over her lesson much more effectively than the mere dentist can. She will take the time and the trouble to prepare and direct tooth-brushing drills, clean teeth honor rolls and clubs in which the sole requirement for membership is the regular use of the toothbrush; and to arrange for plays and movie films teaching good tooth building foods and practices, etc.

The oral conditions that we have to combat and for which prophylactic measures must be instituted are, broadly speaking: (1) gingival and other periodontal diseases; (2) malformation of the jaws and malarrangement of the teeth, and (3) caries.

Group 1. Gingival and other perio-

dontal lesions are comparatively rare in children and particularly so in connection with the deciduous dentition. The following are factors in these undesirable conditions and should be guarded against in a prophylactic program.

(*a*) Poor oral hygiene. As a rule, there is a minimum of deposit on young children's teeth, and light deposit and stains can be readily removed with wood points charged with flowers of pumice and the like, followed by finer polishing powders such as precipitated chalk or oxide of tin on rubber cups. Areas where there is any accumulation of food or materia alba should be noted and, with a mirror in the child's hand, the attention of nurse or parent is called to the locality and how to reach this place with the brush is indicated. A good brushing method for not only the teeth, but the mouth as a whole, is demonstrated. In case there is any considerable accumulation on the teeth, inquiry into the diet will usually disclose that it contained too much carbohydrate, probably too many sweets, and almost surely too few of the fibrous and rough foods which are most valuable for their frictional and exercising effects; those foods which someone, I believe Dr. Rhobotham, characterized as "foods for function as well as nutrition.

(*b*) Neglected gingival caries and proximal caries, poorly contoured fillings and other faulty dental work, such as ligatures and bands impinging on the gingivae.

(*c*) Poor selection of foods as to both mineral and vitamin content, especially a scarcity of vitamins A and C and too large a proportion of soft foods, resulting in insufficient mastication and bolting of food. This last is particularly bad, in that such eating habits tend to become fixed and they deprive the oral tissues of the massage and exercise essential to their health, growth and development.

(*d*) Specific organisms (Vincent's especially). Plenty of fresh fruits, especially the citrus fruits and good oral hygiene, are preventives of this class of disturbances.

(*e*) Mouth breathing. The correction of this, which is essential for many other reasons, will be considered later.

(*f*) Abnormal attachment of the frenum. The lower labial frenum is occasionally found attached so high on the gingiva that, in the movements of the lips, it has the effect of drawing the gum margin down, and, in the stretching, an inflammatory process is set up which, if uncorrected, will cause marked recession of the labial gingivae. The offending tissue should be dissected away from its high gingival attachment and the wound stitched in such a way that the frenum will not become reattached.

The technic of the operation is as follows: The assistant turns back the lip, and the protruding portion of the frenum on the inner side of the lip is grasped with a small hemostat. With a lancet, the tissue in the hemostat is separated from the inner surface of the lip, a hold being retained on this tissue. Dissection is continued downward, an incision being made on each side of the frenum so that all of this muscular tissue can be removed. The incision in the lip tends to spread open a little, exposing the underlying tissue. One or two stitches are taken with black suture silk, J. & J. No. 3, to bring the edges together, a small curved needle bringing the edges into contact. This hastens the healing and prevents the formation of adhesions between lip and gum. The stitches can be removed in four or five days. The operation is done under local anesthesia with a small amount of procaine, and there is usually little, if any, after-pain.

(*g*) Crowding of the teeth. An injury similar to that described above is

often produced by the increased tension on the labial gingivae when one or more teeth are crowded out of position. Circulation is interfered with and a recession or atrophy of the festoon results which may remain as a permanent disfigurement. Here, the preventive procedure is obviously orthodontic treatment to restore the teeth to their correct position in the arch. Crowding of the teeth in any part of the arches is a potential factor in periodontal disease. The injury occurs partly as a result of too great compression, with crushing and traumatizing of the interdental tissues and consequent impairment of circulation, partly through function being interfered with from the resulting malocclusion and partly as an indirect influence through difficulty in maintaining mouth hygiene in these crowded conditions.

Group 2. The importance of normal arches with regularly arranged teeth can hardly be overestimated. The development and maintenance of such a condition is a major consideration in any program of prophylaxis. The underlying causes are often obscure and unforseeable, but every effort should be made for their prevention.

1. First among preventive measures, we have those already referred to for the building of good bones and teeth through the development of a healthy child; i.e., the correct chemical and physical character of foods and their thorough mastication.

2. Under early recognition of harmful habits and their prompt correction, we have (*a*) incorrect pillowing, which may cause asymmetrical development; (*b*) mouth breathing, due often to an adenoidal or other nasopharyngeal obstruction, to be promptly referred to a specialist, and often the result of thumb-sucking, which is thus doubly harmful; (*c*) thumb-sucking, for which various and sometimes fantastic causes have been stated. If undernourishment or the opposite, that is, such a free flow of milk that the sucking act is too easy and is unsatisfying to the infant, is responsible for it, the habit ceases with the removal of the cause. Otherwise, some kind of mechanical device may be indicated to keep the hands from reaching the mouth or the thumb from touching the palate, until such time as the child's pride or intelligence can be appealed to. I know of one instance in which a child under 3 years of age stopped sucking his thumb by being made to feel sorry for the "poor little red thumb." Some children may be shamed into correction of the habit or their vanity may be appealed to. An excellent suggestion is that of Dunlop, of Johns Hopkins University; i.e., to make the child conscious of the habit by requiring him to look at himself in the mirror while he indulges in the habit for several minutes. Delabarre[1] says of injurious habits:

> Most important is early detection of faulty functional habits. Well-established, they are well-nigh impossible to break. The best method of correction is the establishment of normal habits through exercise. Function influences form, and bad function results in malformation. Breathing through the mouth is an example of malfunction that results in a characteristic bad facial expression with an open mouth, underdeveloped nose and upper lip, faulty speech and possible malocclusion. All sucking habits induce faulty function. Improper use of tongue and lips in speech upsets the balance of function. . . . It is not the amount of force exerted in these and other habits but the constant repetition that does the damage.

Lewis, of Detroit, who has written extensively and authoritatively on the subject, has concluded that thumb-sucking is

1. Delabarre, F. A.: Preschool Age Dentistry, J.A.D.A., 20:124 (Jan.) 1933.

an etiologic factor in a great many orthodontic cases. He has found that with correction of these harmful habits by the fifth year, their effects automatically disappear; whereas, left uncorrected until a later period, the deformity remains unless mechanical intervention is used.

3. Whenever approximal caries occurs, the mesiodistal diameter of the teeth should be restored with some sort of stable filling material.

4. Deciduous teeth should be removed at the proper time. If, at 13 years of age, any deciduous teeth remain firm, they should be examined by the roentgen rays and if their successors are present, the first should be extracted. Otherwise, the permanent teeth may be deflected or prevented from erupting altogether. On the other hand, if the roentgenogram fails to disclose a permanent tooth coming on, it is most desirable to retain these deciduous ones. A savable deciduous tooth that has not commenced to loosen or show any evidence of resorption should not be extracted without roentgen-ray evidence and information. In many cases, these teeth without permanent successors have been retained well into middle life, some with large gold inlays, a few with porcelain jacket crowns. This may seem undue trouble to take with a mere fragment of a deciduous tooth, but on considering the alternative, the placing of a bridge, meaning at least partial mutilation of other teeth for abutments, its worthwhileness as a conservation procedure must be granted.

5. Deciduous teeth should be retained until time for their successors, if any, to erupt. This may necessitate partial extirpation of the pulp or its complete removal and filling of root canals, or even the treatment and sterilization of infected canals. These teeth can be retained with benefit and safety in most cases and will resorb normally unless the roots have previously been pus-soaked by a prolonged suppurative process. In this case, the tooth should be extracted. Premature extraction of these teeth may be the only means of relief in the occasional case of a child impossible to control, but it is rare indeed that such cases are encountered. We have frequently removed pulps from deciduous incisors devitalized by falls or blows for children 3 years old and younger, the child even tolerating a rubber dam when necessary. I call attention here to a recent symposium of the Society for Promotion of Dentistry for Children on treatment of fractured anterior teeth.

After 4½ years, when resorption of the root is under way, and the normal expansion of the anterior part of the mouth has commenced, it is better to extract offending incisors, and no mechanical device will be necessary to retain the space. When it becomes necessary to extract a deciduous incisor prior to the fourth year or a molar before time for its successor to erupt, the space should be kept under observation, and if evidence of closure is seen, a space maintainer should be placed.

Dr. Lewis, in one of the articles referred to above, discredits the idea, pretty generally accepted, that when the deciduous incisors have not begun to separate by the fifth year, crowding of the permanent teeth is inevitable.

When, in spite of all precautions, the arches are so irregular that mechanical intervention is unavoidable, the sooner an orthodontist is called in on the case, the better. If consulted in time, he can often recommend muscle exercises and the use of various artificial chewing devices and thus avoid the placing of regulating appliances on the teeth. Often, all that is necessary is to give nature a slight impulse in the right direction at the right time and she will do the rest. To quote Lewis again: "Some apparently ortho-

dontic conditions are but phases of normal development to be watched and the family background inquired into before interference is considered." We have occasionally been embarrassed when, after insistence on treatment to which the patient would not consent, the condition was later automatically overcome.

In officies in which no orthodontic work is done, a rather embarrassing situation occasionally arises. The child, having had all cavities filled and teeth cleaned, goes into the hands of the orthodontist (of our own or the parent's choosing), thereafter having to make regular visits to this other dentist. The parent seems to think that all dental needs will be looked after or at least detected as they appear; but, as a matter of fact, the orthodontist who confines his practice to that specialty often has neither enough interest in the matter, nor the instruments, nor the tactile sense to detect the beginnings of caries. It would seem most desirable that the pedodontist include orthodontia in his practice; in other words, the child's interests will be best served if the dentist in charge of straightening his teeth is also sensible to and on the lookout for other conditions that may arise. A few men are combining the two specialties, but as far as I know, this is not general. A recent survey with regard to the teaching of children's dentistry made by the Society for the Promotion of Dentistry for Children disclosed a trend in the direction of coordinating orthodontia and pedodontia. Dr. Rhobotham strongly advocated this combination.[2]

Group 3. Caries in children is the most prevalent disease the prevention and control of which are to be considered. The abundant, interesting and valuable literature on diet and other systemic factors in their relation to dental caries need not be reviewed here. Suffice it to say that no matter how great may be the variance in opinion with regard to the protective or immunizing effects of diet in adult life, there is not a reasonable doubt that nutrition and metabolism do play a large part in fortifying young teeth against caries.

The problem of prevention of caries in children is thus to be attacked from both systemic and local angles. In general, we may say that any diet that is favorable to the development of the child will tend to build sound teeth. Conversely, nutritional deficiency diseases are to be especially avoided as predisposing to caries. Among these are scurvy, rickets, pellagra, endocrine disturbances and the exanthematous diseases, which are especially harmful during enamel formation. Whenever possible, the child's diet should be handled in cooperation with a pediatrician.

One factor frequently overlooked in prescribing diet is the environmental one of climate. The importance of this has been forcefully brought to our attention recently in the work of Dr. Martha W. Jones on infants and children living in the almost continuous sunshine of the Hawaiian Islands.

The paramount importance of early dietary measures in preventing caries should constantly be borne in mind. A few months of deficiency at this time will with difficulty be compensated for later on, if at all.

Recent research of Logan and Kronfeld has given us valuable information and changed some old established ideas regarding tooth development. Their experiments were made postmortem on human specimens. Hess, Lewis and Roman, who have made successive roentgenograms of children's jaws from birth

2. Rhobotham, F. B.: Children's Dentistry in Relation to Orthodontia, J.A.D.A., 20:865 (May) 1933.

through the adolescent period, have thrown further light on the matter.

We are overlooking one of our best means of serving our patients intelligently when we do not take advantage of the results of such investigations, and incidentally we are depriving ourselves of something which adds infinitely to the interest of our profession and takes us out of the routine of its sometimes too mechanical activities, into the broader inspiring field of science.

Development, it has been shown, does not coincide with the eruption of the teeth. The crowns of the bicuspids are fully formed at 4½ years, but at 11, when they usually erupt, the pulp chamber is still large with root end wide open, and calcification of the root end is not complete before the age of 14 or 15. This explains the results obtained in some of the diet experiments. We surmise that comparable results could not be had in an older group and venture to agree with the opinion that all dietary or other measures designed to affect the teeth through metabolic channels must be administered during the growing period.

The local factors in caries causation may be divided into (1) structural and morphologic, and (2) environmental. The latter are best reached through regular so-called "prophylactic treatments." Statistical records by dentists in private practice and in institutions furnish abundant proof of the value of such treatment, and if D. D. Smith, Fones, Garvin, Spalding, Morrey and others have not proved that a clean tooth will not decay, they at least have demonstrated that the incidence of caries can be reduced to a minimum by such means with great benefit to the patient from both the economic and the health standpoint.

It has been found most practical in our office to telephone for the young patient when he is due for this attention, and the time between visits depends on the individual case and is determined by the conditions found in the mouth. Sometimes, the individual has to be called every three months, or even oftener for a time, and later this same child can go for as much as a year without needing attention, although it is never safe to risk more than a six months' interval during childhood, if gross lesions are to be prevented. The young patient at each visit has his brushing technic reviewed, unless the mouth is found entirely free of débris, in which case he is commended for his good work. In reviewing the brushing technic, the child is asked to show us how *he* brushes his teeth, and being supplied with a suitable brush, he demonstrates how he is accustomed to doing it, and faults are corrected as they appear.

The importance of coarse fibrous foods as natural "brushes" cannot be too often emphasized, as well as the injurious local effects of eating sticky, pasty things such as cake and candy between meals and allowing them to remain there until fermentation takes place.

Sufficient time should be given for these prophylactic treatments that a careful examination of mouth and teeth may be made after the regular polishing of the teeth has been finished. When a dental hygienist attends to this cleaning of the teeth, it too often happens that a corresponding appointment for examination is not made with the dentist, and the patient does not get the benefit to which he is entitled.

A thorough examination of the occlusal surfaces of the posterior teeth, both deciduous and permanent, should be made as soon as they appear; for, in spite of all precautions, developmental faults will occur. These faults are most often caused by failure of the enamel lobes to

coalesce in the formative period, or they may result from pressure within the tissues of the jaw during development which tears apart the enamel rods and prevents further calcification. Such developmental defects, being the results of natural forces, are of course unavoidable, but they must be given prompt attention. Otherwise, caries will develop, and, in young patients, the progress of the disease is comparatively rapid.

Pulpitis supervenes, exposure of pulp, infection and suppuration, with direct, and perhaps indirect, injurious effects to the general health. We will therefore neglect no means at our command to detect and treat pre-carious or potentially carious pits and fissures.

Wherever possible, the region to be investigated is isolated with cotton rolls, and the teeth wiped with alcohol and blown thoroughly with compressed air. An extremely fine-pointed explorer is passed over the surface to be examined, and often it is desirable to employ binocular loupes or a powerful magnifying glass in doubtful places. If the explorer catches in the pit or fissure, this is cut out and filled, or rounded out and polished, and only the deepest part, which may involve the dentin, is filled, the surface after treatment being left in such shape that the bristles of the toothbrush can reach and keep it clean, all according to Dr. Hyatt's technic, with which you are doubtless familiar. It is fundamentally sound.

Let us emphasize to the parent the necessity of seeing children as soon as each group of molars erupt; also, whenever one of the deciduous second molars is lost. Many times, a filling in the mesial surface of the first permanent molar can be avoided by polishing or applying silver nitrate promptly, or a permanent simple filling can be inserted in place of an extensive compound one before the bicuspid comes into place. Howe's silver nitrate treatment may be used to advantage to check beginning caries in the proximal surfaces of deciduous teeth, but too much reliance should not be placed on this, and frequent check-ups should be insisted on when it is used.

The roentgenogram is not necessary for the detection of caries, although it may be a helpful adjunct to the explorer, mirror and floss. It is very useful at times in showing the depth of caries and its proximity to the pulp. Also, of course, it is invaluable for determining conditions around pulpless teeth and for locating unerupted teeth, impacted teeth and other such dental abnormalities.

In conclusion, let me add three basic considerations in prevention: (1) thorough familiarity with the normal; (2) understanding of the etiology of oral diseases, and (3) early and frequent examination.

SEPTEMBER DAYS ARE SCHOOL DAYS

Do the educators in your schools know that they can secure authentic dental health educational material from the Bureau of Public Relations of the American Dental Association?

Make it your business to inform every school principal and teacher and every school board member in your town or city that your Association can supply them with dental health educational material.

Better still, write today for free copies of the Association's lists of dental educational material and supply your educators with them. Address: Bureau of Public Relations, American Dental Association, 212 E. Superior St., Chicago, Ill.

THE SUMMER ROUND-UP OF THE CHILDREN*

The general summary of results of the 1934 Summer Round-Up of Children, a health activity of the National Congress of Parents and Teachers, is as follows:

Total number of Congress units registering for the Summer Round-Up	6,431
States represented	47 and Alaska
Communities represented	2,580
City groups	3,683
Town groups	1,422
Rural groups	1,326
Total number of units carrying through the Summer Round-Up	3,568
States represented	47 and Alaska
Communities represented	1,417
City groups	2,315
Town groups	748
Rural groups	505
Number of these units which met the national campaign requirements	3,152
Number of units which held the spring examination and fall check-up but corrected no defects	368
Number of units which held only the spring examination	328
Number of units which failed to carry through the work or were unable to send definite information regarding progress made	124
Tabulation of reports shows:	
Number of children entering school (kindergarten or first grade) Fall of 1934 in districts where the Round-Up was carried on	168,073
Number of these children receiving Round-Up examination	92,268
Number of children examined by family physician	18,308
Number of parents or guardians present at the examination	67,593
Number of children examined who needed medical care	39,891
Number of these children receiving medical care	15,100
Number of children examined who needed dental care	34,972
Number of these children receiving dental care	13,716
Number of children receiving vaccination against smallpox	34,113
Number of children receiving immunization against diphtheria	27,101
Number of children receiving inoculation for typhoid	3,928
Number of children receiving tuberculin test	2,837

A FEW FACTS

There was an increase of 219 groups which carried through the Round-Up.

There were 4,471 more children examined than in 1933.

Protection against diphtheria was made possible for 3,509 more children and against smallpox for 1,437.

As a result of the Summer Round-Up campaign, 13,183 children outside the Round-Up group received an examination; and 7,848 other children were vaccinated against smallpox, and 6,309 immunized against diphtheria.

*A Health Activity of the National Congress of Parents and Teachers, 1201 Sixteenth Street N. W., Washington, D. C.

There were 18,308 children examined by family physician and dentist.

Since the Round-Up was inaugurated in 1925, a total of 505,336 children have been examined.

INTERESTING PERCENTAGES

70 per cent of the groups which registered sent in reports of work accomplished or progress made.

55 per cent of the units which registered carried through the Round-Up.

49 per cent of the units which registered received the Certificate Award for meeting the national campaign requirements.

6 per cent of the units which registered held the spring examination and fall check-up, but did not secure correction of defects.

5 per cent of the groups which registered held only the spring examination.

55 per cent of the children entering school in districts where the work was carried on received the Summer Round-Up examination.

18 per cent of the children examined were examined by the family physician and dentist.

30 per cent of the defects discovered were corrected.

43 per cent of the children examined needed medical care and 38 per cent received medical care.

38 per cent of the children examined needed dental care and 36 per cent received dental care.

37 per cent of the children examined were vaccinated against smallpox.

29 per cent of the children were immunized against diphtheria.

GENERAL SUMMARY

Number of defects discovered:							
Nutrition	8,788	Tonsils	27,645	Abdomen (including hernia)	1,677	Speech	1,566
Skin	2,101	Adenoids	15,137			Feet	3,873
Posture	6,413	Nose	2,515			Miscellaneous	9,759
Eyes	4,216	Glands	9,138	Genitals (including hernia and need of circumcision)	3,284	Total	136,931
Ears	2,655	Heart	1,680				
Teeth	35,535	Lungs	949				
Number of defects corrected:							
Nutrition	2,700	Tonsils	7,781	Abdomen (including hernia)	350	Speech	410
Skin	1,100	Adenoids	4,352			Feet	1,049
Posture	1,313	Nose	682			Miscellaneous	3,377
Eyes	1,472	Glands	1,871	Genitals (including hernia and need of circumcision)	782	Total	41,388
Ears	1,010	Heart	433				
Teeth	12,390	Lungs	316				

Number of other children examined as a result of the Summer Round-Up Campaign 13,183

Number of defects discovered among this group 13,159

Number of defects corrected among this group 3,453

Number of other children vaccinated against smallpox as a result of the Summer Round-Up Campaign 7,848

Number of other children immunized against diphtheria as a result of the Summer Round-Up Campaign 6,309

DENTAL ECONOMICS

THE FUTURE STATUS OF THE DENTIST

By HAROLD W. OPPICE, D.D.S., Chicago, Ill.

IT is hazardous indeed to prophesy about anything at any time. It is extremely difficult to attempt to foretell the future status of the dentist at a time when there is so much uncertainty in the air as now. Yet from a careful study of the past and a clear understanding of the present, we may expect to get a fair glimpse of the future.

The average dentist is and has been classified in the upper strata of society, a professional man of high standing and one who makes a humble but an honest living. He is and has been credited with being a good citizen, ever striving to better his community, his profession, his family and himself.

During the past decade, we have passed from a prosperous era to one of great financial depression, and as history has so often recorded, this sudden change has been accompanied by a preponderance of propaganda for a revised social order. Many methods have been proposed for stabilizing economic conditions and providing a fuller measure of economic security. Already, some of these have been tried and found wanting. Others are in the process of experimentation, and no doubt still others will be given a trial in the future. When the final results are tabulated, if history does repeat itself, it will be found that some social and economic reforms have been accomplished that are of great value, while others will prove to be even more vicious than those of the previous era. We are concerned here with proposed changes that will directly affect the dentist in the practice of his profession.

We are familiar with the recent studies and report of the Committee on the Costs of Medical Care, with its majority and minority recommendations. We are aware that it was insinuated, if not wholly maintained, by the majority report that there was need for a change in the methods of practice of the health professions, in order that the cost of health services be reduced, and further that this reduced cost be paid for by its wide distribution among great numbers of people. We are further aware that the minority report disagreed with this recommendation because it would involve some form of socialized health legislation, which, it was maintained, had proved a poor solution to the same problem in foreign countries. It should be noted that this study and report was instituted and carried to completion during the last years of our late prosperous era, and it has often been said that had it not been for the sudden onset of the present depression, it would have been filed away in a dusty archive and forgotten. Whether this supposition be truth or fallacy, we shall never know.

Shortly after the inauguration of the present administration in Washington,

we find an agitation on the part of our government to legislate social security for the masses. This is an age-old and tricky procedure on the part of political leaders in all countries during depression years, a political showman's device to gather in votes by high sounding yet impractical measures.

With the advent of this revival of social security legislation, we in America have come face to face with the problem of compulsory health insurance for the first time. To state briefly the intent of this reform measure, we can safely say that it is an effort to compel the great majority of people by law to contribute a percentage of their incomes to a common fund from which a health service would be provided for them in time of need. It is a companion piece to several other compulsory social insurances and movements which have for their objective a "share-the-wealth" program. It is a vital part of the plan of all those who believe in or advocate the public collective management of the affairs of all individuals. It is very different from voluntary health insurance, which we are so familiar with in this country. It is definitely socialistic in principle and entirely foreign to what we have heretofore considered in keeping with American principles of government.

During the last few years, it has been increasingly common to find some individual reciting the trends of social economics for the purpose of stating that compulsory health insurance was on the way to the United States and therefore it behooved the medical and dental professions to bestir themselves, study the problem and decide which form was best for the professions and the public. It has been deplored by these "recital-of-trend" artists that the health professions did not receive this proposal with open arms. They have attempted to laugh to scorn the idea that the principles of compulsory health insurance were fundamentally wrong. They have issued solemn warnings that if the professions did not concede the point or principle involved, advocate the desirability of the measure, cooperate with government proponents of the idea and thereby gain as much control of the operation of the scheme as possible, we, as doctors and dentists, would be forever doomed. This attitude has emanated from several sources: the American Society for Social Security, certain philanthropic foundations, certain types of economists favorable to the "New Deal" program and a few members of the health professions.

The most recent activities of the American Society for Social Security have been along the line of preparing model compulsory health insurance bills and causing them to be introduced into several of the state legislatures. These legislative measures have received nothing but condemnation from the members of the health professions, even those members who have been in favor of the principle of health insurance. It is prophesied that none of the state legislatures will pass this measure as sponsored by the American Society for Social Security at this session.

The propaganda for compulsory health insurance emanating from some of the philanthropic foundations has long been with us. The proponents have often been severely criticized for their ill-conceived ideas of social reform.

There is no need for us to review either the wisdom or the folly of the "New Deal" principles. They are available to us all daily, and you can interpret and judge them as well as I. It might be well to mention in passing that the federal government as represented by the President and the President's Committee on Social Security have recently seen fit

to approve the principle of compulsory health insurance. They have approved it so strongly that when recently the Medical and Dental Advisory Committees to the President's Committee met for the purpose of council, they were advised that no discussion of the relative merits of compulsory health insurance would be permitted. This was done in spite of severe criticism from both the American Medical and the American Dental associations, who have repeatedly gone on record as being opposed to all forms of compulsory health insurance.

We will consider at this point the recent activities of certain members of the dental profession who may be said to be fostering compulsory health insurance.

In the State of California, the councils of the California and Southern California Dental associations adopted a resolution which says in part that they "recommend that legislation be proposed seeking to establish a health insurance system, mandatory as to certain population groups and voluntary as to certain population groups," and that "the California and Southern California State Dental associations immediately offer their full aid and cooperation to the Interim Committee of the Senate of the State of California charged with the study of this problem." In the City of New York, we find the First District Dental Society passing a somewhat similar resolution, which reads:

Resolved, that the First District Dental Society approve in principle the current endeavors to provide adequate dental service for the low-income group of the population by a socially equitable method of distribution of the costs of such service, and be it further

Resolved, that a committee of five be appointed to intensively study the problem and report to the Society within three months, a model dental section that may be incorporated in any health insurance bill that may be introduced in the New York State legislature.

It should also be mentioned here that recently a "straw vote" type of poll was circulated among the dental profession on the subject of health insurance by a dental magazine owned and controlled by forces outside the dental profession. The results of this poll indicated that of the 9 per cent who returned their ballot, eleven of every thirteen were in favor of some form of health insurance program different from that which is now available to the people of this country. The methods of conducting the poll, the propaganda for compulsory health insurance published in this magazine preceding the poll and the lack of well-stated and understandable questions which could be clearly and easily answered prejudiced many against voting or even believing that the answers returned conveyed the intended meaning of the voter. Because of these contentions, few have attempted to draw any real conclusions from this poll as to the true opinions of the majority of the dental profession.

It might be well to consider some of the reasons advanced for the apparent sudden turn in favor of accepting the principle of compulsory health insurance by a strong minority of the dental profession as evidenced by the adoption of the previously mentioned resolutions in California and New York City. Of major importance are the following:

1. A sincere and honest belief by a very few that social security can be accomplished by legislative efforts of government and that the adoption of a compulsory health insurance program would be of great assistance in furthering this ideal condition.

2. Repeated, loud and clever arguments by certain members of the dental profession that we are going to get some form of compulsory health insurance

whether we want it or not, and that it is better to accept a new principle in order to be on the inside looking out rather than on the outside trying to get in, have no doubt had the desired effect on many.

3. Recent activities of the present administration in Washington regarding a social security program in general and compulsory health insurance in particular have caused many to fall in line in the hopes that they may get first chance at good political appointments, which would necessarily be made if compulsory health insurance is adopted.

4. A belief that an acceptable form of compulsory health insurance can be framed that will be both practical and efficient from all standpoints if the organized medical and dental professions are placed in control of all methods of professional practice involved has caused many others to become advocates of this plan.

5. The emotional appeal to our scientific-minded profession to experiment with this social change for a time, and if it is found wanting, to discard it, has also found fertile ground.

6. The age-old habit of those in financial distress to agree to anything giving promise of a better monetary return has caused the greatest number to succumb to this policy. These dentists are forsaking a true and tried principle of long standing in the hopes that, in the new order of things, they will be better able to provide for themselves and family. It is because of this last reason and it alone that many of our profession have taken sides with the economic planners of social security and its accompanying compulsory health insurance feature. The mirage of greener pastures on the other side of the fence has again, it is feared, led astray many short-sighted persons.

It is conceded that whether these or any other reasons be advanced for advocating a system of compulsory health insurance, it is the privilege and right of any individual member or component society of the American Dental Association to differ with the judgment and policy of the parent organization. It is surprising that it was felt necessary to carry a discussion of this difference of opinion to the public press, as was done in a recent issue of the *Literary Digest,* rather than to the floor of the House of Delegates of the American Dental Association. It is possible that the discussion could not be kept from the press, but the decision to accompany the difference of opinion with a public defamation of the elected leaders of organized dentistry is a traitorous act. It is deplored that any member of dentistry should have sunk to the level of a gutter-snipe politician. Surely society will not give the wishes of our organizations due consideration if we resort to tactics of this nature.

We have frequently read in the medical and dental journals arguments against the adoption of compulsory health insurance. Most of these have been based on a careful and exhaustive study of existing conditions in countries in which this type of insurance has been in practice for some time. It is not necessary to review at length these deductions, but a short digest of them may assist us in arriving at logical conclusions:

1. Compulsory health insurance has never been satisfactory to enough people in any country to warrant its adoption in this country.

2. It has been necessary to change constantly the objectives as well as the regulations and provisions to prove the utter impracticability of the entire policy.

3. In but few instances has it been reported that the public and the professions are satisfied with the measure.

4. The patient-practitioner relationship has not been maintained in its traditional form.

5. The service to the patient has been of inferior quality as compared to that rendered to private patients.

6. The system has stifled the incentive to advance in the professional practitioner.

7. The system has reduced the income of the professional men rather than increased it; the exception to this being those who had almost their entire practice in the lowest income group before insurance. These have had a slight rise.

8. The system has become involved in politics, and politics and a good health service cannot go hand in hand.

9. The health professions have become a regimented group of governmental workers, so much so in fact in England that they have recently organized a trade union and affiliated with the British National Trades Union.

10. The newest and most modern of all plans, that established in France in 1930, is proving a failure as far as accomplishing desired results.

11. In Germany, the country which first adopted compulsory health insurance fifty years ago, we find economists as well as dentists and some representatives of government openly advocating the complete abolishment of the system. Many curtailments have recently been made by order of Mr. Hitler.

10. Finally, the health of the people has not been materially bettered because of these programs.

It is true that social investigators hired by institutions and organizations who are proponents of compulsory health insurance have constantly refuted most of these arguments. As if in answer to the question of who is right and who is wrong, we find coming out of Germany but very recently a pamphlet entitled, "Will America Copy Germany's Mistakes?" This is a brief résumé of two books written in Germany by Mr. Gustave Hartz, of Berlin, a noted German labor economist, who writes from the workmen's point of view, not the employers' or the professions'. I hope each one of you here will avail himself of the opportunity of reading this pamphlet from cover to cover. It will prove somewhat enlightening, I am sure. I quote a few passages here:

When, under the great statesman Bismark's chancellorship, social insurance was first introduced, he was, and not without reason, warned against taking this "jump in the dark," for nowhere did any experience in the matter exist.

Now, the introduction of social insurance no longer means jumping in the dark; we look back on an experience of fifty years, that points out the way to real social politics—and at the same time shows how they should not be made.

It is not advisable to give ear to the biased experiences of advocates of social insurance who, in many cases, draw profits therefrom, for there is no institution in all the world that is so much extolled and the praise of which is so little justified as social insurance. . . .

Woe to the State which imagines that crises may be alleviated or stopped by the introduction or the existence of a comprehensive system of social insurance! Sad disappointment awaits it. Every economic crisis swallows up the best organized social insurance and consumes its funds at both ends—at the end of the diminishing premiums and at the end of the increasing benefits. . . .

Medical science has become a cheap article, and doctors have given up conscientious treatment. The genuine patient is neglected, is not given the necessary care.

The greater the mass consultations, the lower are the doctor's fees. The amounts paid to panel doctors for each single case are deplorable. They are therefore compelled to resort to mass practice. The sick

insurance unrolls the entire problem of the medical man's existence.

Mass demand compelled a limitation in the use of medicines. Doctors must not prescribe what they consider good for the patient, they only being allowed to give remedies entered in a book of medical regulations for insurance purposes.

The insured workman becomes a second class patient. . . .

The genuine patient is justly indignant to find that the existence of his illness is doubted, and that he who has always paid his premiums regularly and has a right to demand conscientious attendance, is considered a cheat.

This system, together with the rest of the bureaucratic apparatus, has wedged itself between doctor and patient, completely destroying the patient's confidence in his physician, which greatly retards all recovery. . . .

In the beginning nobody thought of insuring all workmen, merely needy ones. But soon everybody was "needy." Today, with members of families included, two-thirds of the nation are compelled to be insured. . . .

Liberty and progress are possible only where the will to get on and to accumulate capital is not hindered, but furthered. . . .

Independence and a sense of responsibility of the citizens are the only means to save a state from too great a social burden, as was the case in the United States before the great crisis came. There the inexorable "I must" drove everyone on, for no social insurance existed to take the trouble from the people in the time of reverses.

It is apparent from these quotations that the stand taken by the medical and dental organizations against compulsory health insurance is sound.

To the great credit of the medical and dental professions in this country, it can be said that they are attempting to solve the problem of adequate health service for the "low income group" by other means. Many experiments are being tried in local communities for providing a health service to the needy without doing injury to the moral standards or health of the patient. These experiments are entirely under the guidance of the health professions. Briefly, they are designed to distribute an adequate health service for a fair and equitable fee, payable on the installment plan. This fee is determined by a central health service bureau and varies with the patient's ability to pay. As to the success or failure of these experiments, little can be said at this time. But the desire and the ability of the health professions to handle the problem should not be challenged.

From what has been reviewed here, many prophecies as to the future status of the dentist might emanate. It is possible at times to be very pessimistic and again at others the exact opposite. I had originally intended to close the discussion at this point and let you be your own prophet, but for fear that I may be accused of evading the issue, I have set down the following predictions:

1. A form of compulsory health insurance will not be passed by the present congress in Washington nor will one be generally adopted in the near future.

2. The health professions, by the result of local experiments with central health service bureaus, will solve the problem of giving adequate health service to the "low income group" at equitable fees.

3. The future of the average dentist will be brighter than the immediate past or present because history, thus far, has recorded that the proverbial silver lining to every cloud is an actuality.

THE PLACE OF DENTISTRY IN THE DEVELOPMENT OF THE PROPOSED MATERNAL AND CHILD HEALTH PROGRAMS

IF passage of the Economic Security Act takes place, a way will be opened to prepare an active campaign for maternal and child care. A recent conference was held at the Children's Bureau in Washington and standards for state divisions of maternal and child health, personnel and programs, were adopted. These standards were also approved by state and territorial health officers.

The opening statement of the report which was drawn up during this conference is quoted herewith in full, as it indicates the broad principles based on the cooperation which will be accorded the dental as well as the medical profession:

In planning for a local health program for mothers and children in counties or districts, especially in rural areas and small centers of population, it is believed that emphasis should be placed by the health authorities, in cooperation with medical associations and other local groups, on the development of certain minimum health services for mothers and children unable to obtain them otherwise and on state and local programs for education of lay and professional groups in the essentials of adequate maternal and child care. The use of local committees on child health and welfare (composed of representatives of local professional and lay groups) to assist in developing the educational program, in establishing the minimum services, and in extending them to meet local needs should be considered in developing any plan. In the light of experience in the recent past in many sections of the country and of the urgent need, it is believed that medical and dental services should be provided preferably by local physicians and dentists qualified to do the special work required and paid by the local health department. Nursing service should be provided through the employment of full-time public-health nurses by local health departments to work under the general direction of the health officer and under the immediate supervision of public-health nurses experienced in such supervisory work in the maternal and child-health field. When local physicians and dentists are not available, other arrangements for the various services would have to be made. The educational and preventive aspects of both maternal and child-health services should form an important part of the service rendered by physicians and dentists. In all the health services full cooperation of local medical and dental organizations should be obtained.

The report continues under various headings, and it is to be noted that the whole report indicates that dental and medical services are to be an integral part of these proposed plans.

It is stated that the office of the physician and the dentist is the preferred place to furnish examination, treatment and education in matters of health.

Preschool and school children, and also those children who are about to leave school to engage in industry, are singled out for special emphasis for work to be given them.

State-wide planning in cooperation with medical and dental organizations for the education of parents and with special emphasis on the ways and means of obtaining these essentials is stressed.

It is important that each state dental society be prepared to cooperate with the

state health officer who is the responsible head in the development of plans that will accord with principles of organized dentistry.

The development of a continuing program of postgraduate courses, institutes and "refresher" courses will bring the current knowledge into the fields of maternal and child care.

It is further recommended that a full-time dentist be added to the staff of the Division of Maternal and Child Health in the state health department. Also, part-time regional consultants in the field of dentistry as well as in pediatrics are recommended.

It is planned that dental hygienists give special demonstrated programs, and appointment of a special staff in the field of nutrition, mouth hygiene and health education is among other plans submitted.

The dental profession is to be congratulated on the outcome of this conference. The program adopted is probably the most comprehensive one that dentistry has ever had presented to it in the matter of child care.

Miss Katherine Lenroot, director of the Children's Bureau, and Dr. Martha Elliot are well aware of the preventive work that lies in the field of dentistry.

The contacts made by the Committee on Economics have borne fruit, as indicated by the program adopted by the conference.

We confidently expect the heartiest cooperation from those who have this work in charge as they possess a most intelligent grasp of the work that they are about to inaugurate.

It is hoped that the dental profession of the various states and territories will cooperate whole-heartedly with the efforts of Miss Lenroot and her fellow workers.

MEDICAL SOCIETY PLANS

THE June, 1935, issue of the *American Medical Association Bulletin* is devoted almost exclusively to a special report of the Bureau of Medical Economics of the A.M.A. The bureau reports that approximately 200 different experiments are being conducted or considered by county medical societies to provide a more equitable distribution of medical service. These experiments are so diverse and varied that classification is difficult. Some plans are of such a nature that they are not easily placed in any simple classification. Using as a basis the latest available statistics (February, 1935), the bureau reports that two state medical societies have plans for general care in operation and four state medical societies have proposed plans for general care under consideration. One state medical society has a plan for care of the indigent in operation and one has an indigent plan proposed.

A number of county medical societies, notably in California and Washington State, are operating a medical plan for general care. A few county medical societies, the largest bloc of which is in Texas, have a proposed plan for general care. A large number of county medical societies, notably in Iowa, Kansas, Pennsylvania and Michigan, have a plan for indigent care in operation, and several others have a proposed plan for indigent care.

Several state and county medical society plans for the payment of hospital care are also listed.

Brief descriptions of several different

types of plans are included in the report, such as (*a*) a special fee schedule; (*b*) medical care for the indigent; (*c*) voluntary budgeting for medical care—prepayment plan and postpayment plan; (*d*) voluntary budgeting for hospital facilities; (*e*) special services; (*f*) regulation of hospital, clinic and dispensary admissions and routing of hospital traffic, and (*g*) industrial group service.

The Bureau of Medical Economics states that it is impossible to make all county medical society plans conform to a single general pattern. Local conditions demand that while an equitable plan must conform to sound principles of ethics, medical and legal requirements must be adjusted likewise to local necessity. "If it is believed that a county medical society plan will add to the completeness and more even distribution of medical care in a community, the organization of such a plan should be predicated on a thorough knowledge of local facilities and requirements. . . . It is usually better to expand existing plans than to start entirely new ones. . . . The size of the problem to be attacked should be definitely determined. . . . It is much easier to experiment with a small plan and expand it . . . than to start with a big scheme involving new and cumbersome administrative machinery." The plan should recognize a definite division between the indigent and the low income classes. The bureau defines low income as one in which the annual income is so small that payments made for medical service will reduce the amounts available for such necessities as food, housing and clothing below good health standards, usually placed between $900 and $1,500, according to local conditions. An upper income limit should also be fixed as a precaution against the establishment of practices not contemplated in the original plan. "Illnesses may be divided into minor and major or 'catastrophic.' Except for the indigent, the provision for medical service in minor illnesses is seldom an important economic problem."

In "border-line" families, medical expenditures of $50 or more may bring about an economic situation that will impair the health of the entire family. Hence, the proper adjustment of medical charges according to ability to pay is paramount and depends on an exact knowledge of the incomes of those served. This will probably involve an investigation by medical social workers. Social service work as applied to medical service should always be guided by medical opinion.

Special emphasis should be given to preventive measures. Many county medical societies are already cooperating with public health departments or private organizations in preventive campaigns.

Not only should the county medical society diagnose the health needs of the community, but it also must survey the existing medical facilities to be used in supplying the needs. Wherever possible, it is the function of the medical societies to organize these services for more equitable utilization for all who need them. This calls for an organization of all available medical facilities and for the systematic routing of patients in relation to physicians and institutions.

The Bureau of Medical Economics says: "There is nothing inherently good or bad, from a medical point of view, in different methods of collection. Insurance, taxation, budgeting, advance financing and all other methods are nothing more than tools with which to conduct an economic transaction. They remain nothing more than this and can be discussed impartially *if they are kept strictly within the economic sphere.* The problem is to select the best method for every purpose. The chief thing to keep in mind is

that *all forms of collection should be isolated from control of service and be kept exclusively in the economic field.*" Some societies have found a collection agency operated by the society, one prepared to assist in the adjustment of payment, to be a good plan. Some collection plans develop financing features of assistance to both patients and physicians. At the beginning of the plan, the physicians may not receive the equivalent of full fees for their services even though a sliding scale plan is used, because a certain amount of gratuitous service is involved in any form of medical service. At the same time, high grade medical service cannot be provided permanently unless the payment for such service is sufficient to enable physicians to maintain that standard by further education and a corresponding standard of living.

In making suggestions for the general administration of a county medical society plan, the bureau says: "A central administrative office will be required to which all calls for medical service should come or be reported. This office should then refer these to the investigating agency for an economic diagnosis and to some physician for a medical diagnosis and treatment or reference, if needed, to the proper institution. . . . After such individual economic and medical diagnoses have been made it is possible to fix a fee and determine methods of payment which will meet the situation as well as the conflicting elements of income and need will permit. That is all and indeed far more than can be said for most wholesale schemes of reorganization of medical service."

Most of the plans evolved by the state and county medical societies to date involve in general the following steps:

1. Study of local medical facilities to determine the nature and extent of medical problems for which adjustment is needed.
2. Definition of persons or income groups for whom medical benefits should be provided.
3. Development of a method of determining the patient's ability to pay.
4. Determination of the amount and nature of the medical service to be provided.
5. Organization and cooperation of community medical services supplemented by new units of administration when necessary.
6. Systematic movement of applicants for medical care.
7. Determination of the manner of presenting a plan to the public and method of securing members.
8. Establishment of a method of making collections or receiving payments for medical care.
9. Establishment of a method of remunerating physicians for their services to patients receiving benefits under the plan.
10. Administrative details.

ECONOMICS—WHAT SHALL WE DO WITH MONEY, IF AND WHEN WE MAKE IT?*

I take my hat off to those of you who have been successful in amassing a competence.

One of the things that promoted this little paper was a slight familiarity with what the A.D.A. is doing in the way of relief to aged and ailing dentists who are no longer able to take care of themselves. I believe if some of those unfortunate men had followed some such suggestion as I hope to make, the story would have been different. Incidentally the

*Extracts from a paper by N. S. Cox, 601 Professional Building, Miami, Fla., published in the Florida Dental Journal.

best work the A.D.A. is doing is with the relief fund. I believe if the work was brought more closely to the attention of all dentists, they would favor as I do, all able bodied dentists in the United States contributing at least five dollars per year, instead of one, in order to swell that fund to real proportions.

Dr. Nicholas Murray Butler, in a report to his trustees, recently said: "The notion now preached with such vehemence in various parts of the world that there is some hypothetical, invisible and all powerful state which is in necessary control of every individual life and effort is so far below the level of established human knowledge that it is not easy to describe it in language that would be deemed parliamentary. There is no substitute for individual effort and responsibility, and no system of government can relieve us of our obligation and duties and hope to live."

The feeling has grown in millions of minds that they should be supported by some vague form which they call government, never seeming to be able to grasp the fact that there is no government power not derived from individual tax payers, and that means you and I.

Dentists are notorious victims of quick and quack money making schemes. Their strong boxes all over the country are full of beautifully engraved, embossed and embroidered certificates, entitling the holders to a share in the profits, if any, in some new and wonderful project which cannot fail to make them big money. Gold mines in California and Alaska, apple land in Washington, rubber or sugar cane in Central America, oil land in Texas and copper mines in New Mexico. I have some dandies of my own. All this is not due to lack of intelligence on the parts of dentists. Many bankers and business men have done worse, for they not only were misled themselves, they misled many others. It is largely due to that universal desire to get big returns for a small investment, losing sight of the one great fundamental principle in investment—the safety of the principal.

Operation of the average dentist on the stock market reminds me of a couplet in the Macon Telegraph which said: "A man in Macon chanced to see a patent cigar clipper; he wondered if his finger was not quicker than the clipper; it wasn't."

When I started the practice of dentistry, a local doctor or dentist who had acquired a good farm and a bit of city property was considered comfortably fixed. I tried to follow suit, and in a few years I had two farms in the north and a large cotton plantation in Alabama. For a time I made money on them, but if I had not seen the handwriting on the wall in 1920 and slipped from under at a good price they would have swamped me, for a year later they were not worth fifty cents on the dollar, and have been a liability rather than an asset ever since.

I tried rentals, stores, apartments, houses, and had irate ladies pop into my operating room in the midst of a gold foil contour demanding that I redecorate their bedroom, or stop a leak in the kitchen sink. I tried construction, buying and selling, but each carried a burden of detail both during and after office hours, and of all things a busy dentist does not want is interruption during office hours. The very nature of dental practice, with the close application required, makes the handling of outside business an unmitigated irritation, and should be avoided. So the problem of investment simmers down to finding some place for idle money with a minimum of care and attention.

The recently passed Stock Exchange Bill which purports to free the market from pools and unreliable stocks, making investment safer for the ordinary man in practice works the other way around. For instance, the Standard Oil Company of New Jersey recently wanted to refund $90,000,000. The Exchange Comimssion has ruled that if an issue of securities is offered for sale to the public it must go through an expensive process for listing, but if sold to less than twenty-six people it is not a public offering. So Standard Oil got $45,000,000 from one firm of bankers, $8,000,000 cash and issued $37,000,000 in new debentures, none of which you and I could buy under the law.

A mutual friend recently talked with the president of the largest bank in south Florida

and was told that he had sixteen millions of his funds invested in government bonds; asked why, he said he knew no other way since the banks are so hedged about with restrictions as to loans and investments, and he had to play along with the government.

So what is a poor devil of a dentist going to do with his dollar and a quarter?

All I can do is to suggest a course that seems best to me at this time. I have an old friend who practiced dentistry for thirty-five years in an ordinary railroad town in the north. He was diligent and economical. When he decided to retire he had put $75,000 in life annuities which pay him $500 per month. He has been twice to Europe and a trip around the world. He has no business worries or anxieties. I asked him how he felt about his plan. He replied, "If my investment fails the foundation of the United States will fall out."

The reason he made that reply is this: the insurance companies of A1 rating always have money for investment, and they have available all the firsts in grade A bonds, offered by the best firms with a gilt edge set up, such bonds as I mentioned being issued by Standard Oil of New Jersey, which probably have more real security back of them than government bonds today.

Not every man has the ability or good fortune to save $75,000, but every man can save something, and in the first year of practice can put aside a little, provided the lure of new cars or fruitless spending is not too great.

The annuity companies have made it possible for the smallest savings to be profitably invested. The only form of investment for most people is that which can be paid for in small sums annually, and this is where the annuity plan shines the brightest. The great advantage for such persons in an annuity contract lies in the enforced saving of small sums that would otherwise be spent for trifles, and are so small as to be difficult if not impossible to invest in any other way that is safe.

There are few men in dentistry today who do not virtually throw away much more than $100 each year on useless if not harmful activities, and yet a young man of thirty putting $100 a year in an annuity will find that at sixty he has, with no real inconvenience to himself, an annuity of $27 per month, or cash available in lieu of income near $5,000 or if he lets it run until he is sixty-five he will have over $50 per month income, or a proportionate increase in cash value.

The average dentist, in the period between 30 and 65 could easily save ten times $100 per year, if done systematically, and so have a guaranteed income that would make him free from worry for the balance of his life, and in the meantime save himself and family a world of worry and anxiety.

The best insurance authorities I know agree that, given 100 men at 25 years of age, at 35, ten years later, 5 are dead, 10 wealthy, 10 well to do, 40 living on earnings, and 35 show no improvement. At 65, 36 are dead, one is wealthy, 4 well to do, 5 live on their earnings and 54 are not self-supporting.

If those figures are approximately correct it behooves every man to get busy with a remedy. For the average man who does not have enough cash available to buy an annuity in one payment, the best plan is the retirement annuity, paid for in annual installments over a period of years when earnings are good, and it can be started on as low a basis as $10 per month income, and multiplied as one is able to increase annual payments.

But now comes the question which many have already asked: what if the insurance company fails? The answer is, it will not, barring an upheaval like that in Russia, and in that case nothing would matter. There are many reasons why on old line insurance company will not fail. One lies in the very nature of life insurance business. Its liability is limited to one hazard, life, which is the least variable of any insurance risk. Mortality tables show with almost mathematical precision the approximate amounts needed to meet accruing obligations each year. This enables the companies to invest in the most stable

long time securities, which are bought for income and not for sale, and are held until maturity.

There is no institution that has so wide a range of investment as the life companies. Territorially, they cover the entire country and include every economic interest, and closely watch those already held for any sign of weakness.

Constant, vigilant and perpetual management of a great diversity of investments is at the service of each member of the company. Life insurance companies are not subject to runs, in a panic. When money is placed with them the intention is to leave it there, and members surrender their policies for cash with the greatest reluctance. Bank deposits are so placed to have money available for any need, and a panic demand for deposits may wreck the best bank in the world.

No human institution is infallible, but the position of the leading life insurance companies is so impregnable that nothing short of a national catastrophe that would wreck the government itself would seem to endanger them.

Tempus has a most alarming way of fugiting, and the beard of old Father Time will be longer, and his fingers will be in your hair in spite of all you can do, so it behooves you to be diligent and sensible with your money, if you want to have gold in your purse when there is silver in your hair.

AMERICAN DENTAL ASSOCIATION COMMITTEE ON ECONOMICS

During the past year, the Committee on Economics of the American Dental Association has collected a fund of valuable information on dental economics throughout the United States. Credit for this work is due the members of the economic committee and their deputies, whose names are listed below. At the present time, the economic committee consists of fourteen members one from each Trustee's district and one from the U. S. Public Health Service. Each district committeeman has appointed a deputy in each state in his district to assist him in collecting and distributing dental economic information. As rapidly as new developments occur and studies are made, the committeemen and their deputies forward information to the secretary of the Committee on Economics at the Central Office, who, in turn, disseminates this information either in the economic section of THE JOURNAL or through the monthly press releases.

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ADVISOR TO ECONOMIC COMMITTEE
E. G. Meisel, 121 University Place, Pittsburgh, Pa.

RESOLUTION OF THE WEST VIRGINIA STATE DENTAL SOCIETY APPROVING THE ACTION OF THE TRUSTEES OF THE A.D.A.

WHEREAS, we are confident that the Board of Trustees of the American Dental Association has given ample study and deliberation to the problem of health insurance, and we believe their conclusions and attitude are based on sound and honest conviction, and

WHEREAS, the unanimous decision of this body on the subject of health insurance should be accepted as the nation-wide opinion of organized dentistry, and

WHEREAS, we approve the dignified and ethical conduct of their procedure in contradistinction to the publicity methods of certain advocates of health insurance, and

WHEREAS, there is an infinitesimal and wilful minority who are not official spokesmen for either the organized medical or the organized dental profession, and this minority is operating as a group of spellbinders and spreading propaganda at every opportunity, and

WHEREAS, these proponents of health insurance admit that as it is practiced in other countries, it is both impracticable and demoralizing, and

WHEREAS, all of their proposals to institute the insurance system in this country are couched in vague generalities, platitudes and indefinite recommendations, and

WHEREAS, the American Dental Association through its Board of Trustees has adopted the following resolution: (See Action of the A.D.A. Board of Trustees in Respect to Compulsory Health Insurance, THE JOURNAL, April, 1935, p. 698.)

Resolved, that the West Virginia State Dental Society approves the action of the American Dental Association and directs that the Board of Trustees of the American Dental Association and all component societies be so advised.

PRESS RELEASE SERVICE NOW AVAILABLE TO MEMBERS

For the past several months, the Committee on Economics of the American Dental Association has issued timely press notices on current economic and other subjects to the state and component society editors.

Congratulatory letters from the editors indicate that the releases are most worthwhile. Believing that other members of the Association might wish to take advantage of this service, we are offering a one year's subscription to this service for $1. The committee issues approximately ten releases each month.

Send your subscription with $1 attached to the Secretary of the Committee on Economics, American Dental Association, 212 E. Superior St., Chicago, Ill.

CURRENT LITERATURE

Adenocarcinoma of the Oral Cavity (W. L. Watson, Am. J. Roent. & Rad. Therap., 34 [July] 1935): The author describes in some detail the pathologic progress and clinical course of forty-one cases of intraoral adenocarcinoma. It is believed that this type of tumor is derived from minor salivary glands of the oral cavity, from aberrant thyroid tissue or from mucous glands. For this reason, it is not easy to classify the cases on a histologic basis, and though necropsy is important, gross examination is more conducive to accurate diagnosis. The author's photomicrographs illustrate various types. These tumors give a history of round or oval, slowly growing, painless lumps in the mouth that may take on active, rapid growth at any period of their development. They are firmly elastic, but sometimes fluctuation may be elicited. The surface may be smooth or lobulated, slightly thickened or thinned out, with prominent capillaries running superficially through it. Ulceration of the mucous membrane may occur, and deep fixation to underlying structures is the rule. The palatal lesions are apt to be pale and shiny and reddish-yellow, while those arising at the base of the tongue are more likely to present a deeper reddish granular appearance. Encapsulation is often more apparent than real. Distant metastases are common, as are also local recurrence and bone invasion. They are clinically quite radioresistant. Treatment is by a combination of external and interstitial irradiation followed by cautery excision. The prognosis is poor.

GRANT VAN HUYSEN.

Missing Teeth in Skulls and Dental Caries (W. M. Krogman, Am. J. Phys. Anthropol., 20:43, 1935): This report deals with the evaluation of data in the determination of prehistoric caries. The utilization of collections of prehistoric and primitive skulls to form the basis of a comparative statistical analysis of the frequency of dental caries "then" and "now" is not warranted unless certain factors are considered. The present study demonstrates that from 50 to 75 per cent of incisors and from 33 to 50 per cent of the cuspids are apt to be absent in cranial collections, and that these teeth comprise from 55 to 75 per cent of the total teeth absent. It is concluded that from 4 to 5 per cent of these missing incisors and cuspids, 10 per cent of the missing bicuspids and from 10 to 20 per cent of the missing molars are to have been considered as having been carious. When this correction has been made and when the age, sex, environment and group homogenicity are considered, it will be found that the difference in the frequency of dental caries is not so marked between early primitive peoples and civilized peoples as is generally believed.

ALTON D. BRASHEAR.

Radium Dosage and Technique in Carcinoma of the Mouth (F. E. Simpson, Am. J. Roent. & Rad. Therap., 34 [July] 1935): A brief discussion is given of the technic and dosage employed in treatment of oral carcinoma. With the aid of block anesthesia or topical application of cocaine, biopsy is made with small sharp cutting forceps or a small pair of scissors. Treatment of the primary lesion is accomplished by application of radon in lead tubules, unless the lesion is too extensive. The author believes it is safer to irradiate in each case with the highest possible dosage, whether the tumor is classified as radioresistant or radiosensitive. This procedure is to be recommended in carcinoma of the tongue regardless of the pathologic type, but it is contraindicated in the presence of lymph node metastases. After a discussion of the method of implantation and postoperative treatment, the article is concluded with a

discussion of prognosis and treatment used in case of nearby metastases.

GRANT VAN HUYSEN.

Acrodynia (William Brewer, J. Kansas M. Soc., 36:225 [June] 1935): This disease, also known as Swift's disease, erythredermia and pink disease, occurs in infants and young children, running a course of months. It is characterized by maceration of skin over the hands and feet, or elevation of the blood pressure, tachycardia, degenerative changes in peripheral nerves, nerve roots and spinal cord photophobia. In severe cases, the teeth fall out. Grinding of the teeth seems to give relief. Ulceration of the gums and necrosis of the jaws occur. There may be a shedding of the hair and the fingernails. Brewer gives two case histories. He advises as treatment heavy doses of ultraviolet light, brewer's yeast, fresh fruits, phenobarbital and diothane ointment, with particular attention to oral hygiene.

T.

Eruptive Fever with Stomatitis and Ophthalmia (G. J. Ginandes, Am. J. Dis. Child., 49:1148 [May] 1935): Ginandes reports the case of an eruptive fever with cutaneous, buccal and ocular lesions similar to those of the two cases described by Stevens and Johnson (*Am. J. Dis. Child.*, 24:526 [Dec.] 1922) as instances of a new clinical entity. Similar cases described by Rutherford and by Wheeler are discussed. The literature is reviewed, and the striking resemblance of these cases to certain others reported as instances of atypical erythema exudativum multiforme (Hebra) is pointed out. The suggestion is made that all these strikingly similar cases be considered as belonging to one group. The exact classification and nomenclature of such a group are left open for further study and investigation. If the term "erythema exudativum multiforme" is to be retained, it is suggested that the name "Stevens-Johnson" be substituted for "Hebra" in order to emphasize the unusual features of this disease. —Abstr., *J.A.M.A.*, 105:150 (July 13) 1935.

Orr Treatment of Fractures and Osteomyelitis: Please describe the Winnett Orr treatment of infected fractures and osteomyelitis.

Orr's method was developed as a reaction against practices which included timidity in operating, overboldness in operating, failure to drain adequately, inability to recognize acute bone abscess, and too many disturbances during the patient's attempt at healing. The principles of the Orr treatment include: (1) good surgical operation, providing adequate drainage, (2) wide-open packing of the wound with petrolatum gauze, (3) immobilization of the extremity and (4) the minimum number of dressings. Orr's chief contributions to this subject are: (1) the reduction in the number of dressings; that is, the reduction in the number of times the wound is exposed to further contamination and the reduction of the pain and suffering that are caused by repeated dressings; (2) rest of the wound; (3) avoidance of painful dressings, and (4) the saving of the bacteriophage. Orr advises: (1) an immediate adequate drainage at whatever stage the osteomyelitis is encountered; (2) the maintenance at rest of inflamed parts by the application of a plaster-of-Paris cast, aided if necessary by ice tongs or other means of skeletal fixation; (3) wide-open drainage by means of a sterile petrolatum pack; (4) primary asepsis or antisepsis, avoiding the use of irritating antiseptics in the wound; (5) postoperative care, emphasizing rest without antiseptic dressings, which usually increase and complicate infection; (6) maintenance of all injured parts, bones and soft parts, in their correct anatomic position during the entire period of healing. In a discussion of the treatment of compound fractures, Orr states that a certain dexterity in the use of moleskin traction, plaster-of-Paris and skeletal traction devices, sometimes included in plaster-of-Paris casts, is essential. He states that these appliances are not only comparatively simple and easy to use, but also more effective than other splints and traction devices in ensuring more permanent length, correct position and immobilization. The first operation sees the wound cleaned and the

bones immobilized in the correct position. Orr states that, when a compound fracture occurs, the bones involved are not only broken, but also thrown forcibly out of their normal position. It is therefore of paramount importance that these bones be restored as nearly as possible to their correct position and that between the time of fracture and the time of restoration as little damage as possible be done to the tissues surrounding the fracture. To insure this, it is best to splint the patient at the scene of the accident and to place the bones in the correct position at operation and immobilize them. It is highly important that this immobilization be maintained. Wound treatment is secondary in that it is possible to provide an aseptic wound that will heal easily and satisfactorily while at the same time giving primary consideration to the fractured bones. He advises wide open drainage without the use of drainage tubes, usually without sutures.—*J.A.M.A.*, 104: 2386 (June 29) 1935.

Chronic Granulocytopenia of Five Years' Duration with Recurrent Acute Attacks: Case Report (C. L. Stealy, Am. J. M. Sc., 189:633 [May] 1935): Stealy presents a case of chronic primary granulocytopenia which has been under observation for five years. The symptoms, history, physical observations and blood counts during the acute attacks and during the periods of remission present a typical picture of the chronic primary type of the disease without ulceration. On three occasions, an increase in neutrophils was noted a few hours before, after or at the same time the total leukocyte count started to fall. The fall of the neutrophil count from this higher point was abrupt and caused a complete reversal of the neutrophil-lymphocyte ratio. It is possible that such an increase in neutrophils may be used as an indicator of an oncoming acute attack. Drugs of the benzine ring were discontinued after the first acute attack in 1929. Pentnucleotide was given in two of the most severe attacks. The rise in the leukocyte and neutrophil count corresponded to the results apparently obtained by its use by Jackson. Only supportive measures were used during other less severe attacks. During the periods of remission, various forms of medication have been tried. Concentrated forms of vitamins B and D, in addition to a well-balanced diet, have been given empirically since June, 1934. During this time, there has been apparent improvement in subjective symptoms and a rise in the general level of the leukocytes and the neutrophil-leukocytes to within normal limits. This line of treatment is being continued on the basis that granulocytopenia may be a deficiency disease in the same way that pernicious anemia is one.—Abstr., *J.A.M.A.*, 104:2393 (June 29) 1935.

Congenital Clefts of the Face and Jaws: A Survey of Three Hundred and Fifty Cases in Which Operation Was Performed (Harry P. Ritchie, Arch. Surg., 28:617 [April] 1934): In this review of 350 cases, especial attention was given to familial incidence and associated deformities. There were thirty-four cases with familial incidence and twenty-six cases with associated deformities. The combination and degree of the clefts were grouped. The first group contained thirty-eight cases with a prealveolar process cleft. In this group, the alveolar process and the hard and soft palates are normal. The defect is that of a cleft in front of a normal alveolar process. In this type of cleft, the repair operation may be performed any time after feeding is established and the baby is gaining weight. The second group consists of cases of postalveolar process cleft. In this group, the lip and the alveolar process are normally united. The hard and the soft palate are cleft in varying degrees. In this group, there were fifty-six cases in which operation was performed. The average age at which operation was performed varied from 14 months to 2 years. The third group, consisting of cases of alveolar process cleft, shows many possible combinations. The combination determines the type of operation and the time of operation. In general, the repair of the alveolar process cleft should be done first, as early as is compatible with the condition of the child.

The repair of the lip is left to the judgment of the operator. Repair of the hard and soft palate should be postponed to the second year or later, with particular attention to the season selected for operation. Only five infants died of the 350 operated on. The low mortality was attributed to the great care taken in selecting the proper time for operation. The results of operation on the various types of deformities are described.—Abstr., *Am. J. Dis Child.*, 50:226 (July) 1935.

Ludwig's Angina, with Report of Cases (David St. Pierre Asbill, J. South Carolina M. A., 30:55 [March] 1934): Asbill reports six cases of Ludwig's angina in patients ranging in age from 5 to 65 years. He emphasizes two points: (1) carious and decayed teeth as important causative factors and (2) the necessity for early treatment by incision and drainage at the most pendant portion, preferably by the submental route.—Abstr., *Am. J. Dis. Child.*, 50: 270 (July) 1935.

Black Tongue and Halitosis: For more than twenty years a patient has had on the posterior part of the tongue a grayish thick covering with a strong foul smell. The patient is now about 40 years old. The reaction of the saliva is slightly acid. With an alkaline mouth wash the patient gets a stomatitis. Weak solutions of boric acid and Burow's solution burn; chamomile flower tea, a teaspoonful to a glass of water, is well tolerated. Internal iodide medication had to be dropped repeatedly, as signs of intolerance developed. Brushing the tongue morning and night with a soft toothbrush has been tried with no success as yet. Aside from the described condition the patient has a vasomotor rhinitis. May I ask you for advice as regards the treatment and is there any hope for cure of this condition?

Bad odor of the breath associated with either coating of the tongue or a hypertrophy of the papillae just in front of the circumvallate papillae and in the median line is not a rare condition. Apparently the odor is generated by a growth of fungi about the base of the elongated papillae or beneath the coating. The condition described may be a variety of the clinical entity known as black tongue, as the pigmentation in this defect varies from brownish black to light gray. Foul odors emanating from the mouth as well as from the nose occur in such forms of atrophic rhinitis as ozena, but not in vasomotor rhinitis. In any event, treatment is indicated only for the purpose of eliminating the bad odor. Usually, thorough swabbing of the region with strong hydrogen dioxide followed by irrigation with warm physiologic solution of sodium chloride is effective if repeated a number of times. In stubborn cases a suitable brush with soft bristles may be used, but, because the foul smelling deposits are located at the base of the papillae, patience and persistence are required. In obstinate cases of black tongue, Prinz (Diseases of the Mouth and Their Treatment, Philadelphia, Lea & Febiger, 1935, p. 436) recommends the use of a 10 to 15 per cent solution of salicylic acid in equal parts of alcohol and glycerin, applied on a swab and followed by irrigation with salt solution. The use of scrapers or other methods of mechanical removal has been advocated, but, as Prinz warns, such treatment is likely to promote recurrence.—*J.A.M.A.*, 105:303 (July 27) 1935.

Foreign Literature

Black Hairy Tongue or Hyperkeratosis Linguae (H. E. R. Stephens, Brit. J. Surg., 22:877 [April] 1935): A case is reported in which the growth was excised with complete cure. Three illustrations, two in full color, are used to describe the gross and microscopic characteristics of the case.

Hamilton Robinson.

Speedier Production of the Finished Radiograph (A. E. Barclay, Brit. J. Radiol., 8:373 [June] 1935): The author points out that while development and fixation cannot be speeded up, the washing and drying process certainly can be accelerated. By using small washing tanks with the water running fast (so as addition of more films does not pollute the water), a film can be perfectly washed in from three to five minutes. The film is then run through an or-

dinary household wringer to remove drops of water and dried in a strong draft of air at about 160 F. Thus, in fifteen minutes, a film is completely processed, and satisfactorily washed and dried.

M. K. HINE.

Ueber die Structure von Zahnstein (Calculis dentalis supragingivalis) (H. Philipp, Ztschr. f. phys. chem., 223:209, 1935): A sample of calculus submitted for minerologic examination was shown to contain a crystalline phosphate mineral, optically biaxial and negative, and therefore classified as apatite. Philipp studied samples by roentgen-ray diffraction (Debye-Scherrer method, using Cu-K_2 radiation) and found apatite patterns. To discriminate between hydroxy-apatite and carbonate-apatite, samples heated for a long time at 600 C. were found to give the pattern of β-tricalcium phosphate, a behavior typical of hydroxy-apatite in the presence of excess phosphate. CO_2 is present in too small amounts to permit identification of its form, i.e., calcite or aragonite. Therefore, the calculus is considered to consist principally of hydroxy-apatite, with an excess of phosphate adsorbed from the phosphate-rich saliva.

HAROLD C. HODGE.

Dent Dans Une Paupiere et Colobome Palpebral (Van der Straeten and Appelmans, Arch. d'Ophtal., 51:417 [July] 1934): A case of an accessory denticle in the lower eyelid is reported in a 5-year-old boy. A small swelling existed from birth at the inner canthus of the right eye and at the time of operation had doubled in size. A denticle 7 by 4 mm., well-formed but not calcified, possessing a pulp chamber and normal structures and suggestive of a normal unerupted tooth, was removed. The authors found four somewhat similar cases in the literature.

HAMILTON ROBINSON.

Report of Eleven Instances of Adamantinoma (L. McGregor, Acta Rad., 16:254, 1935): Eleven cases are presented, with history, treatment and pathology. In one case, that of a 69-year-old woman, the tumor disappeared under radiologic treatment alone, with no recurrence or palpable metastases in six months. The malignant cases from the literature are reviewed and it is concluded that the atypical features demonstrated by these are: (1) a marked cellularity of the stroma, in some cases as extensive as fibrosarcoma or (2) a preponderance of cuboidal over stellate and cylindrical types of epithelial cells or (3) a preponderance of epithelium over stroma with marked intertwining and tree-like branching of the epithelial processes.

HAMILTON ROBINSON.

Pains in Shoulders and Arms in Heart Disease (H. Wantoch, Schweiz. med. Wchnschr., 65:497 [June 1] 1935): Wantoch calls attention to connections between pains in the joints and muscles and heart disease, giving especial attention to the pseudorheumatic pains that most frequently appear in the shoulders and in the upper extremities and are related to angina pectoris. These pains are not only an accompanying symptom of angina pectoris, but also quite often the initial and for a long time its only symptom. The early recognition of the character of these pseudorheumatic pains is of importance for the treatment. Although the localization in the left shoulder and arm predominates, they may appear also in other portions of the body, for instance in the throat, with radiation into the neck, the lower jaw and the teeth; then there may be headaches that are chiefly localized in the occiput. The pains that accompany angina pectoris may appear also in the form of epigastralgia and hypogastralgia, particularly on the left side, or in the form of pains in the right side of the thorax, or in the right lower or upper extremity, or in portions of it, such as the olecranon or the thumb. However, such pseudorheumatic pains appear not only in angina pectoris but also in cardiac insufficiency. The author observed a number of these cases and points out that the cardiogenic pathogenesis of the pains was corroborated by their prompt disappearance after medication with digitalis.—Abstr., *J.A.M.A.*, 105:236-7 (July 20) 1935.

Agranulocytosis in Conjunction with Plaut-Vincent's Angina (Friedrich Szirmai, Arch. f. Kinderh., 101:9 [Dec. 19] 1933): A 4-year-old girl entered the clinic with a deep acute ulcer on the right tonsil. Smears showed fusiform bacilli and spirochetes. A diagnosis of Plaut-Vincent's angina was made, and the ulcer was painted several times with a solution of arsphenamine. A few days later, intense icterus appeared, and the ulceration spread. The blood picture showed 65 per cent hemoglobin, 2,535,000 red cells and 2,800 white cells, 1 per cent of which were neutrophils, 1 per cent basophils, 82 per cent lymphocytes and 16 per cent monocytes. Complete recovery followed within about two weeks. The author considers this case to be one of secondary agranulocytosis caused by Plaut-Vincent's angina.—Abstr. *Am. J. Dis. Child.,* 49:1657 (June) 1935.

New Case of Xanthomatosis Generalisata Ossium (I. Snapper and S. Posthuma, Maandschr. v. kindergeneesk., 3:324 [May] 1934): A man, aged 25 years, had five spontaneous fractures since the age of 11 years. On roentgenograms, multiple foci in the bones were visible. The diagnosis of Recklinghausen's disease must be rejected, because the calcium metabolism was completely normal. The parathyroid glands were not enlarged. Biopsy of the bone showed xanthomatosis. The cholesterol metabolism was normal. On the mucous membranes of the cheek and mouth, extensive pigmentation like that seen in Addison's disease was present. Injections of an extract of the cortex of the extranasal glands seemed indicated.—Abstr. *Am. J. Dis. Child.,* 49:1664 (June) 1935.

Present Views of the Problem of Osteogenesis (R. Leriche and A. Policard, Presse méd., 42:169 [Jan. 31] 1934): In a careful analysis of the two outstanding theories of bone production, Leriche and Policard conclude that osteogenesis is a phenomenon more humoral than cellular. They reject the classic theory that bone formation depends strictly on the presence of specialized cellular elements, or osteoblasts, basing much of their theory on a recent article by Dubreuil, Charbonnel and Masse (*Ann. d'anatomie pathol.,* 10:225 [March] 1933). To them the fact that bone formation occurs in organs in which no osteoblasts were found, e.g., a tuberculous lung, the thyroid, scars, nerves and walls of aneurysms, is evidence that the process is humoral and not dependent on specialized cells. They believe that the presence of osteoblasts in preosseous tissue may be more reaction than action. Their idea of the process is preosseous edema and local calcium mutation. Calcification depends on material transported by the blood. Ossification in the adult is predominantly a chemical process, independent of specific cellular action. Bone appears, in general, where bone is destroyed or where tissue necrosis has helped to fix the calcium salts in the circulating blood. In conclusion, the authors state that the field of osteogenesis is much more complex and unknown than many believe.—Abstr., *Am. J. Dis. Child.,* 49:1626 (June) 1935.

Teeth in Congenital Syphilis (W. Schwisow, Derm. Wchnschr., 98:101 [Jan. 27] 1934): The various opinions regarding the dental stigmas of syphilis are reviewed. The truly pathognomonic conditions involve the central incisors and the first molars. Changes due to anomalies in the development of the enamel, trauma and dental caries must be carefully differentiated.—Abstr., *Am. J. Dis. Child.,* 49: 1643 (June) 1935.

Experimental and Histologic Study of Pulpectomy (W. Hess, Rev. Odontol., 57: 97-110 [Feb.] 1935): The author studies the methods of Munch, Hellner and Walkhoff under conditions of as perfect asepsis as it is possible to attain. The teeth treated by these methods were then extracted and submitted to histologic examination. With each of the three methods, the pulpectomies were performed on healthy teeth, but there were resulting pulpal infections which did not respond well to treatment. The age of the patient, state of vitality of the pulp and general disposition are factors which should be taken into consideration. The author concludes that the method of

pulpectomy is still in the experimental state. The percentage of failures, even under the most favorable of conditions, indicates the need for further perfection of technic. T.

Normal Dental Articulation (Occlusion)—Its Local, Regional and General Modifications (François Ackermann, Rev. de Stomatol., 37:353 [June] 1935): Believing that there have been no general articles on the normal occlusion, the author undertakes to present and summarize all the known facts, beginning with a presentation of the nomenclature which is based on biophysiomorphology. He points out four periods or conditions of occlusion: 1. Normal occlusion may persist throughout life in a healthy condition. This assumes that the pressures and contrapressures have maintained a state of equilibrium between the teeth, paradontium and the general state. 2. The normal occlusion usually undergoes a period of biologic unstable equilibrium. In this period, one may note a marginal gingivitis accompanied by diffuse alveolar atrophy. The etiology may be humoral, endocrine, toxic, vagosympathetic, mechanical, etc. 3. The normal occlusion may undergo a period of real biologic deficiency. Insufficiency of the supporting tissues is manifested by dislocation of the occlusion. 4. The normal occlusion may undergo a period of early decline, which the author calls precocious senescence. Here, there may be two aspects, one of extreme erosion of the teeth without paradontosis; the other, of relative erosion of teeth and atrophy of the supporting tissue. Changes in normal occlusion afford biophysiomechanical information of great interest and significance to the practitioner.

T.

Diabetic Patients and Surgical Intervention (M. H. Zeses, Greek D. Rev., June, 1935, p. 21): Dr. Zeses contends that, in the treatment, surgically, of diabetic patients, the condition of the tissues needing attention should get first consideration rather than the diabetic condition. The opening of an abscess in such a patient would not injure the patient, but rather would benefit him by reducing the ills that the system has to cope with. The chance of spreading the infection is strong, but with present-day knowledge of how to prepare the patient for the operation, the operation should be done.

GALANOS.

Intranasal Operation for Chronic Maxillary Sinusitis: End Results in Two Hundred Cases in Which the Principles of Küster Were Employed—For the group reached by questionnaire, only nineteen out of 123, or 15.4 per cent, obtained unsatisfactory results; in other words, combining the figures in the two groups, 84 per cent received complete symptomatic relief. In analyzing the causes for dissatisfaction in the whole group of 200 patients, it was found that in seven cases the probable error of failing to diagnose the presence of specific hypersensitiveness was the determining factor. In four cases, bronchiectasis was present and, although this number is too small from which to draw conclusions, it is suggested that bronchiectasis may be a factor in producing the sinusitis, rather than the reverse. In two cases, postoperative complications interfered with a good result; in one case, osteomyelitis of the maxilla; in the other, sphenoiditis. In six cases, misdirected therapeutic efforts were the direct cause of continuance of symptoms, and in two others, inadequate investigation failed to reveal the presence of a frontal sinusitis which maintained the infection in the antrum. In two cases, failure to close a fistula from the alveolus to the antrum was apparently the cause of the difficulty, and in one case in which bilateral intranasal windows failed to relieve the nasal symptoms, bilateral Caldwell-Luc operations elsewhere eliminated such symptoms and apparently also caused marked improvement in arthritis from which the patient suffered.—Henry L. Williams, in *J.A.M.A.*, July 13, 1935.

MISCELLANY

BOOK REVIEWS

Anesthesia in Dental Surgery. By Sterling V. Mead, D.D.S., M.S., B.S. 482 pages; 144 illustrations; price, $6.50. Published by the C. V. Mosby Company, St. Louis.

The science of anesthesia has now been developed to a point where it may be said with assurance that there is no longer any need for patients to suffer from the performance of the routine operations of surgery, and therefore any light that may be thrown on this beneficent service must be accounted a pure benefaction. Dr. Mead has presented a most comprehensive treatise on the subject, and, leading up to it, he has devoted fifty-six pages to the history of anesthesia, forty-six of which relate to the history of general anesthesia, and ten to that of local anesthesia. In outlining an ideal anesthetic, he stipulates the following eight requisites: "elimination of pain, no discomfort to the patient, no ill effects, minimizes post-operative pain and bleeding, does not interfere with the healing process, eliminates all psychic effects of an operation, does not place the operator at a disadvantage, no danger to the patient." This would seem to embody the perfection of anesthetic possibility. In referring to the question of age in administering an anesthetic, Dr. Mead says: "I have found that old age is in itself neither an indication nor a contraindication either for nitrous oxide-oxygen or for local anesthesia. The patient's general condition should govern the choice rather than the number of years." In speaking of the resistant type of patient, he suggests that "this class includes those who are addicted to drugs and alcohol, heavy tobacco users, athletic types, and robust persons." On page 81, in considering persons to whom it is safe to administer an anesthetic, the author says: "There is some misunderstanding on the part of both the profession and the laity as to whom it is safe to administer anesthetics. A widespread impression prevails that if the heart is sound there can be no risk." And then he goes on to cite various authors to the effect that this idea is erroneous, finally quoting the late Dr. De Ford as follows: "I had rather take my chances on anesthetizing a patient with valvular lesion of the heart, a morbid kidney, and an impaired lung, mind tranquil, than to anesthetize a patient who takes the chair white with fear, gasping with short, quick breaths, circulation 'off,' with normal heart, lungs, and kidneys." In view of the growing use of local anesthesia, it is appropriate that Dr. Mead has dealt with this phase of anesthesia in some detail. The limits of a magazine review not permitting adequate consideration of this subject, the book itself is referred to with the assurance that the reader will not be disappointed.

The Autonomic Nervous System. Anatomy, Physiology, and Surgical Treatment. By James C. White, M.D., Assistant Professor and Tutor in Surgery, Harvard Medical School; Assistant Visiting Surgeon, Massachusetts General Hospital, Boston. 386 pages; 94 illustrations; price, $7.00. Published by the Macmillan Company, New York City.

The complicated mechanism of the autonomic nervous system compels the reader to go into a detailed study of this intricate subject if he would get anything of practical value out of it. The anatomy alone as illustrated in the present volume brings visions of Gray in its classic form, and the bibliography is so complete and varied that one is well-nigh bewildered by the amount of material on the subject. To indicate the wide reading of the author, he lists in the one chapter on anatomy no fewer than forty-two references. The most interesting chapters, as would be expected, are the ones

on general physiology, and this calls for no fewer than seventy-nine references in a single chapter. This is merely an indication of the very thorough treatment of the subject, and while a detailed review of such a work is neither indicated nor possible in a periodical devoted to dentistry, profound respect must be accorded the production of such a comprehensive work, with admiration for the manner in which the subject has been treated. The book is divided into three parts, Part I dealing mostly with physiology, Part II with disease processes and Part III with the sympathectomies.

Dental Radiology Handbook. By Houghton Holliday, B.A., D.D.S., Assistant Professor of Dentistry, Columbia University, Assisting Attending Dental Surgeon, Presbyterian Hospital. 78 illustrations; 120 pages; price, $2.00. Published by the Macmillan Company, New York City.

As a frontispiece to this little volume there is a fine picture of Röntgen, a name that will go down in history as that of one of the great discoverers of the age. The present volume seeks mainly to supply the needs of students, and to this end there are ten questions appended to each chapter, through which medium the student may conveniently and systematically follow the subject from the simplest fundamentals up to the technic of taking roentgenograms. The most practical chapter is IX, illustrating the exposure procedures, with the different angles and planes indicated by cuts to show the precise methods in actual use. Another excellent chapter is the one on "Dangers and Precautions." While manufacturers have steadily improved their instruments and made their use safer, there remains the necessity of safeguarding both patient and operator by the greatest care in the manipulation of the apparatus. As so many useful lives were lost in the early days of roentgen-ray work, the precautions suggested in the present volume are appropriate and well timed.

Diagnosis and Treatment of Skin Diseases. Including the Care of the Normal Skin. By Jacob Hyams Swartz, M.D., Instructor in Dermatology, Harvard Medical School; Member of the American Dermatological Association; Assistant Dermatologist, Massachusetts General Hospital; Visiting Dermatologist, Beth Israel Hospital; Consulting Dermatologist, Massachusetts Eye and Ear Infirmary, Boston Psychopathic Hospital, Greater Boston Bikur Cholim Hospital; Instructor in Dermatology at the Nursing Schools of the Massachusetts General Hospital and the Beth Israel Hospital, and Margaret Gilson Reilly, R.N., Graduate Massachusetts General Hospital Training School for Nurses; Supervisor of Skin Diseases, Massachusetts General Hospital; Instructor of Nurses in Dermatology at Massachusetts General Hospital, Peter Bent Brigham Hospital, Children's Hospital, Melrose Hospital, Massachusetts Women's Hospital, Chelsea Memorial Hospital, and Somerville Hospital. 316 pages; 66 illustrations; price, $3.50. Published by the Macmillan Company, New York City.

An appropriate foreword by Richard C. Cabot, M.D., opens this book, and a preface by E. Lawrence Oliver, M.D. For the dentist one of the most interesting and instructive chapters in the book, as indicated by the title page, is "The Care of the Normal Skin." This chapter contains information of a simple character, and the suggestions embodied therein will appeal with equal force to the medical man, the dentist and the laity at large. Because, for the physician and dentist, the care of the hands is of especial importance, and this applies with particular force to the dentist, it is suggested that the authors in revising this excellent book include a consideration of procaine dermatitis. No mention, as far as can be determined, has been made of this affection in the present volume, though the periodic literature has from time to time contained various references to it. The book as a whole is a most commendable presentation of the subject and worthy of a prominent place in every medical and dental library.

The American Illustrated Medical Dictionary. A complete dictionary of the terms used in Medicine, Surgery, Dentistry, Pharmacy, Chemistry, Nursing, Veterinary

Science, Biology, Medical Biography, etc. By W. A. Newman Dorland, A.M., M.D., F.A.C.S., Lieut.-Colonel, M.R.C., U. S. Army; Member of the Committee on Nomenclature and Classification of Diseases of the American Medical Association. With the collaboration of E. C. L. Miller, M.D., Medical College of Virginia. Seventeenth Edition, revised and enlarged. Octavo of 1573 pages with 945 illustrations, including 283 portraits. Philadelphia and London: W. B. Saunders Company, 1935. Flexible and stiff binding. Plain, $7.00 net; thumb index, $7.50 net. Published by W. B. Saunders Company, Philadelphia and London.

The fact that a dictionary, or in fact any other book, runs to a seventeenth edition is *prima facie* evidence of the value of the publication. Little can profitably be said in reviewing a book of this kind. Its compilation, while a task of major proportions, consists for the most part of a mere statement of facts and derivations and manifestly the authors must not or could not indulge in theorizing of any sort. The growth of this volume from an original edition of 770 pages to the present one of 1573 is a very eloquent index of the development of the sciences treated since the book was originally issued, and it is a matter for congratulation not only that these sciences have developed in this remarkable way, but also that the editors and publishers have had the vision to keep pace with this development and to supply the demand thus created for a satisfactory dictionary of terms. Whoever possesses this book may have the assurance that he has the latest and best of its kind.

Proceedings of Memorial Meeting for Edward Cameron Kirk. May 19, 1934, a memorial meeting for Edward Cameron Kirk was held at the Thomas W. Evans Museum and Dental Institute, School of Dentistry, University of Pennsylvania, with the Provost of the University presiding. The proceedings make an interesting volume of 52 pages, embodying a bibliographic summary of Dr. Kirk's life, and addresses by the following: Josiah Harmar Penniman, provost of the University, Joseph L. T. Appleton, professor of bacteriopathology, Hermann Prinz, professor of pharmacology, William Dwight Tracy, trustee of the university, and Charles Root Turner, dean and professor of prosthetic dentistry.

"That life is long which answers life's great end."

CORRESPONDENCE

"Spherical Occlusion"

To the Editor: In reply to a letter, written by J. L. Helmer of Indianapolis, Ind., appearing on page 1448 of the August issue of The Journal, I may say that I am pleased to be offered the opportunity of clarifying what he terms "confusion worse confounded." I cannot, however, allow him to dictate as to what should have been said or omitted. After laboring for ten years or more on this subject, I believe that I am qualified to judge what means should be employed in the presentation.

In the first place, mention of a spherical pyramid in nowise precludes consideration of the triangle and its development of cones of revolution and the cylinder of revolution. As a matter of fact, these developments are of prime importance as the initial steps in the analysis of movements of the condyles.

They begin with the only positive fact at our disposal; i.e., the constant relation of the triangle to the mandibular cast, shown in Figure 2. Two vertices of this triangle lie in the center-points of the condyles. Analysis of the action of the triangle, then, reveals the action of the condyles. From this point on is but a step to determination of the movements of the mandible.

The fact that the triangle *OAB* remains constant in its relation to the mandibular cast, as shown in Figure 2, is the only absolutely positive fact on which to build the argument, and I believe Dr. Helmer will agree that any such development must begin with some indisputable fact if it is to lead to a sound logical conclusion. Therefore, it is essential that the action of the triangle and its developments be considered. As shown in Figures 4, 5, 6, 9 and 10, the triangle is moving on axes. The text and Figures 7 and 8 explain this action

while approaching cusp relations recorded in the wax bite taken at the termination of the right lateral movement. The condyles describe the arcs of circles which are the bases of cones of revolution, in lateral movements, and the circular bases of a cylinder of revolution in the protrusive movement. Please remember that we are analyzing condyle movements now. These circles are shown in Figure 12, which also shows the axes of movement; i.e., *OA, OB* and *CD*. The base of the triangle in successive positions during movement describes segments of cones of revolution as well as the cylinder of revolution. Any surface "of revolution" implies an axis and that is the important point.

When this much had been accomplished, I desired to direct the reader's attention to some gross form of constant dimensions which would involve the remainder of the mandible, especially the occlusal surfaces of the teeth. In order to direct attention over as simple a path as possible, I chose the spherical pyramid, one face of which contains the triangle. I was thinking more of surfaces than lines, since the triangle occupies approximately 80 per cent of the area of the face in which it lies. I expected the reader to visualize the complete pyramid.

After showing that the condyles move on axes, is it not just as permissible to show that the entire mandible moves on these same axes? As a matter of fact, both the triangle and the spherical pyramid move on the axes *OA, OB* and *CD*. The pyramid was used merely as a stepping stone to the entire mandible, and if it causes so much confusion, it may be omitted from any consideration of this subject, because it is unnecessary. If the triangle remains constant to the lower cast, and the triangle moves on axes, the entire mandible moves on the same axes. The base line of any face of a spherical pyramid is of course an arc of a circle. I did not imply that it is not. However, that point has nothing whatever to do with the development of the argument for mandibular movement, although even the spherical sector, mentioned by Dr. Helmer, is compatible with the spherical form shown in Figures 11, 12, 13 and 14, since it emanates from the same center point and involves the same radial dimension.

As for Figure 1, mentioned in Dr. Helmer's letter, it is just as it should be to illustrate the effect of a condyle point progressing along a plane of orientation of an adaptable articulating instrument. The action is exactly the same as that of the point *B* of the triangle held in the hand, and the action illustrated in Figures 7 and 8.

I fear that Dr. Helmer has created his own "confusion worse confounded." His mention of a spherical sector is beside the question.

We are not concerned with the effect of the revolution of the pyramid. It is enough to know that it revolves on an axis. Relative to what Dr. Helmer says about the cylinder of revolution, I reply that he is decidedly in the wrong.

In conclusion, may I ask Dr. Helmer what other theory of spherical occlusion is implied in his last paragraph? He states that "Dr. Monson's theory of spherical occlusion . . . and the theory of spherical occlusion are not necessarily synonymous." Then why the phrase "Dr. Monson's theory of spherical occlusion?"

I cannot agree with Dr. Helmer. Dr. Monson's theory is most emphatically synonymous with spherical occlusion.

C. W. Benson,
1216 Medical Arts Bldg.,
Duluth, Minn.

Procaine Dermatitis Cure

To the Editor: Many inquiries have come to me from dentists concerning the address of the firm putting out Mazon soap and ointment, which I have employed with so much satisfaction in the treatment of procaine dermatitis.[1] These products can be obtained by addressing the Belmont Laboratory, 4430 Chestnut St., Philadelphia, Pa.

Albert E. Atkinson, D.D.S.,
1364 Fillmore Ave.,
Buffalo, N. Y.

1. A Life Saver, Practice in Paragraphs, J.A.D.A., 22:1216 (July) 1935.

NEWS

CALIFORNIA

DCP of SERA: The Dental Care Program of the State Emergency Relief Administration has been officially inaugurated and patients are now being referred to members of the panel. The panel comprises those ethical dentists who apply for such listing and answer certain questions. The dental director was chosen by the SERA from a list submitted by the Dental Advisory Committee. Orlan K. Bullard will serve in that capacity.

Board of Dental Examiners: The Board of Dental Examiners met in Los Angeles, July 14, to establish the final grades for the examination held in that city the last week in June. Twenty candidates for license out of seventy-eight failed to make the required grades necessary to enable them to be licensed in California.

DISTRICT OF COLUMBIA

Medical Bills in Congress: H.R. 8739, introduced by Representative Guyer, of Kansas, proposes to prohibit within the District of Columbia the manufacture, importation, exportation, transportation, sale, gift, purchase or possession of any spirituous, vinous, malt, fermented and all alcoholic liquors whatsoever, which may be used as beverages, except natural wine for religious services, and ethyl alcohol for compounding or manufacturing medicines for internal use and for use as a disinfectant by physicians, surgeons and dentists in their professions.

FLORIDA

Board of Dental Examiners Meeting: The annual meeting of the Florida State Board of Dental Examiners was held June 24-29, 1935 at Jacksonville. Forty-two dentists and six hygienists were examined for license to practice dentistry and dental hygiene. Officers elected for the year are: W. B. McLeod, chairman, A. B. Whitman, vice-chairman, and H. B. Pattishall, secretary-treasurer. The two other members are F. M. York and L. D. Pankey. Dr. Pankey was elected a delegate to the National Association of Dental Examiners. The following resolution was passed regarding predental educational requirements. "After June 30, 1938, provided suitable legislation is enacted, no applicant seeking a license to practice dentistry in Florida will be acceptable without showing credentials incorporating two years of literary training in a university or college recognized by either the Association of American Universities or a recognized accredited agency."

MICHIGAN

Appointment: U. G. Rickert, of Ann Arbor, on the recommendation of President Parks and the Council of the Michigan State Dental Society, has been appointed by Governor Fitzgerald to take the place of C. J. Lyons, deceased, on the Council of the Michigan Department of Health.

Announcement of Postgraduate Dental Education Through Scholarships: The Children's Fund of Michigan announces the establishment of seventeen scholarships, covering the period from Oct. 1, 1935, to June 1, 1936. These scholarships are available to graduates of Class A, American and Canadian Dental Schools, who shall have done better than average work while in dental school attendance, and who are recommended by the deans of the schools from which they have been graduated. Recipients of scholarships will receive postgraduate training in a course of sixty-four lectures and clinics, covering the following subjects: oral surgery, children's dentistry, full denture prosthesis, partial denture prosthesis, dental caries, dental pathology and pyorrhea, dental medicines and therapeutics, root canal surgery and roentgen rays, amalgam, dental materials, crowns and bridgework, orthodontia, office manage-

ment and applied psychology, silicates and cements, gold inlays, medical subjects, dental ethics and public health. Instruction will be given by the Department of Postgraduate Medicine and the faculties of the medical and dental schools of the University of Michigan and other outstanding dentists in the state. Students in the course may register for a certificate of proficiency from the Dental Unit of the Division of the Health Sciences in the University of Michigan, or for a master's degree in the graduate school, registration to be subject to the existing requirements of the university. All students doing acceptable work will receive a certificate of attendance on completion of the course. K. R. Gibson, D.D.S., director of the Dental Division of the Children's Fund of Michigan, 660 Frederick Street, Detroit, Mich., has charge of the details.

NEW JERSEY

Temple University Dental School Added to New Jersey List: At a meeting of the State Board of Registration and Examination in Dentistry of New Jersey, May 24, 1935, a resolution was unanimously adopted to the effect that Temple University School of Dentistry be added to the approved list and that graduates after 1938 with two years of predental work be privileged to take examinations in that State.

NEW YORK

Amendment Banning All Advertising by Dentists: Immediately after the decision of the Court of Appeals in the Brown versus Regents case, there was introduced in the Legislature an amendment to Section 1311, Chapter 21, of the Laws of 1909, of the Education Law in relation to the practice of dentistry. This amendment practically embodied Regents Rule 8, which was invalidated by the court. This amendment passed both houses of the legislature without a dissenting vote, was signed by the governor on April 17, 1935, and became a law immediately thereafter. It is now in force and operation. The effect of this amendment will ban all forms of dental advertising in the State of New York. The amendment reads as follows: An act to amend the education law, in relation to the practice of dentistry. The People of the State of New York, represented in Senate and Assembly, do enact as follows: Section 1. Subdivision two of section thirteen hundred and eleven of chapter twenty-one of the laws of nineteen hundred nine, entitled "An act relating to education, constituting chapter sixteen of the consolidated laws," as amended by chapter one hundred and forty of the laws of nineteen hundred ten and as last amended by chapter six hundred and nine of the laws of nineteen hundred thirty-three, is hereby amended to read as follows: 2. The license and registration of a practitioner of dentistry may be revoked, suspended or annulled, or such practitioner reprimanded, censured or otherwise disciplined in accordance with the provisions and procedure defined in this article upon decision and due hearing in any of the following cases: (a) that the dentist has been guilty of [unprofessional or] immoral conduct; (b) that the dentist is grossly ignorant or inefficient in the practice of dentistry; (c) that the dentist is guilty of fraud or deceit in his practice of dentistry or in procuring admission to practice; (d) that the dentist has employed, hired, procured or induced a person not licensed to practice dentistry in this state, to so practice; (e) that the dentist has aided and abetted in the practice of dentistry a person who is not licensed to practice dentistry in this state; (f) that the dentist has been convicted in a court of competent jurisdiction, either within or without the state, of a crime; [(g) that the dentist is guilty of untrue, fraudulent, misleading or deceptive advertising.] (g) *that the dentist has advertised for patronage by means of handbills, posters, circulars, stereopticon slides, motion pictures, radio or newspapers; (h) that the dentist has been otherwise or in any other way guilty of unprofessional conduct.*

§ 2. This act shall take effect immediately.

OHIO

Resolution: In re the action of the Board of Trustees of the American Dental Asso-

ciation on health insurance, the following resolution was adopted June 9: That the Ad Interim Committee of the Ohio State Dental Society approves the action of the Board of Trustees of the American Dental Association and directs that the Board of Trustees of the American Dental Association and all component societies of the Ohio State Dental Society be so advised."

SOUTH CAROLINA

Proclamation Adopted and Issued: Pursuant to the general trend of educational advancement, the South Carolina Board of Dental Examiners, in Executive session, has issued the following proclamation: That after June 30, 1938, no applicant seeking a license to practice dentistry in the State of South Carolina will be acceptable without showing credentials incorporating the following educational qualifications: 1. The applicant must have had two years of academic training in a university or college, which institution is recognized by either the Association of American Universities or by a recognized regional accredited agency. 2. A diploma from a dental school which is not an integral part of a university, where medicine is taught, will not be deemed sufficient to allow an applicant the privilege of an examination before the South Carolina Dental Board. The proclamation was adopted by the South Carolina Board of Dental Examiners, June 18, 1935.

TEXAS

Appointment: Hubert S. Jackson, D.D.S., San Antonio, has been appointed to the state board of health.

GENERAL

Bill Introduced: H.R. 8941, introduced by Representative Jenckes, of Indiana, proposes "to prevent the adulteration, misbranding, and false advertising of food, drugs, and cosmetics, in the commerce affected, for the following purposes, namely, to safeguard the public health and to protect the purchasing public from injurious deception."

An Act Concerning the Dental Hygienist: Chapter 121, Senate Bill No. 700, Section 236 B of the 1933 supplement to the general statutes, is amended to read as follows: "Any board of education may employ a dental hygienist to clean and keep clean the teeth of school children in attendance at the public schools in such town and the authority therein authorized to appropriate money for the support of such schools in the town wherein such hygienist shall have been employed may make such appropriation as may be necessary for such purpose."

Union Catalogue of Medical Literature: Two years ago the Institute of Medicine of Chicago made available an initial fund for the establishment of a union catalogue of medical literature in Chicago. The work of organization of this project was entrusted to a Committee on Coordination of Medical Libraries in Chicago, which had been appointed a year before. The first aim of the committee was to bring about closer integration of effort among the major medico-biological libraries, including dental and pharmacological, of the city (John Crerar Library, Universities of Chicago, Illinois, Northwestern and Loyola, Rush Medical College) to obviate unnecessary duplication, triplication or even quadruplication of special literature, and divert the economies achieved to a fuller representation of the world's medical literature in Chicago. The second aim was the creation of a union card index centrally placed, so that investigators in medical problems are able to locate the desired reference volumes with the least expenditure of time and energy. It is hoped that eventually the service of the catalogue will be made even more effective by the attachment of a permanent librarian and the availability of information by telephone. The task of achieving such a union catalogue and its cost in effort and money are much greater than the original estimates indicated. The work towards its completion is still in progress, but is pushed as quickly as possible. Every month these different medical libraries are sending in the cards of their new acquisitions, so that the catalogue is brought to date. It is hoped that in time the important holdings in the smaller medical libraries in the city will be represented in

the catalogue. The final editing of this union index may not be accomplished before another two or three years have passed. Despite its present gaps and imperfections, it has already given valuable service to the medical librarians of the city, and to investigators who were aware of its existence. The union catalogue is now open to a wider medical public, which is invited to make use of it for reference and to cooperate in its further development and extension of service. It is to be found on the twelfth floor, or floor of the medical reading rooms, in the John Crerar Library. Further information concerning it may be obtained from the medical librarians indicated above, or from the central office of the Institute of Medicine of Chicago, 629 South Wood Street. Criticisms or suggestions should be sent to the latter. The chairman of the committee is Professor Otto F. Kampmeier, department of anatomy, College of Medicine, University of Illinois, Chicago.—*Science,* 82:54 (July 19) 1935.

FOREIGN

Dr. Banting Honored: Sir Frederick Banting, professor of medical research, University of Toronto Faculty of Medicine, received the gold medal of the Society of Apothecaries of London, June 4, "for valuable services rendered to the science of therapeutics." He was also made a Fellow of the Royal Society and, June 20, delivered an address on the history of insulin at the British Postgraduate Medical School, Hammersmith.

France Bars American Physicians: The parliament of France has passed a law requiring that all physicians and dentists practicing in France shall be French citizens. An amendment deferring enforcement of the law until 1940 was added in the senate. It was pointed out that the decree will probably result in the abandonment of the American Hospital at Neuilly. During discussion of the bill, it was brought out that the University of Paris Faculty of Medicine granted degrees last year to 585 Frenchmen and 237 foreigners.

DEATHS

Blumenthal, Edwin M., Milwaukee, Wis.; Northwestern University Dental School, 1902; died July 18; aged 56.

Greer, Frank Glen, Youngstown, Ohio; Western Reserve University, School of Dentistry, 1914; died May 20; aged 44.

Harper, James A., Corvallis, Ore.; Northwestern University Dental School, 1897; died June 21.

Hawley, Thomas G., St. Louis, Mo.; St. Louis University School of Dentistry, 1903; died July 17; aged 59.

Larson, Walter J., Portland, Ore.; North Pacific College of Oregon, School of Dentistry, 1913; died June 17; aged 48.

McLaughlin, Frank J., Chicago, Ill.; Northwestern University Dental School, 1903; died July 21.

Pride, William A., Gloucester, Ohio; Ohio College of Dental Surgery, 1892; died May 15; aged 73.

Schermerhorn, Alfred Reynolds, Englewood, N. J.; Thomas W. Evans Museum and Dental Institute, School of Dentistry, University of Pennsylvania; died July 10; aged 58.

Snodgrass, Edward G., Chicago, Ill.; Ohio Dental College, 1889; died July 21; aged 72.

Walker, Rowland H., Norfolk, Va.; Baltimore College of Dental Surgery, 1891; died July 19. Dr. Walker was a past president of his local and state societies and for years a member of the state board of examiners.

ANNOUNCEMENTS*

CALENDAR OF MEETINGS

American Dental Association, New Orleans, La., November 4-8.

American Academy of Periodontology, New Orleans, October 31-November 2.

American Academy of Restorative Dentistry, New Orleans, November 2-3.

American Congress of Physical Therapy, Kansas City, Mo., September 9-12.

American Society of Oral Surgeons and Exodontists, New Orleans, November 1-2.

Arkansas City Dental Society, Arkansas City, Kan., October 13-15.

Association of American Women Dentists, New Orleans, November 4.

Chicago Dental Society Midwinter Clinic, February 17-20.

Greater New York December Meeting, New York City, December 2-6.

International Dental Congress, Vienna, Aug. 2-9, 1936.

Midseason Clinic of the Connecticut State Dental Association, New Haven, November 14.

National Board of Dental Examiners, New Orleans, November 2-3.

Odontological Society of Western Pennsylvania, Pittsburgh, October 15-17.

Southwestern Society of Orthodontists, Houston, Texas, October 31-November 2.

Montreal Dental Club Fall Clinic, October 17-19.

American Dental Assistants Association, New Orleans, November 4-8.

American Dental Hygienists' Association, New Orleans, November 4-8.

Society for the Advancement of General Anesthesia in Dentistry, New York City, third Monday in February, April, October and December.

District of Columbia at George Washington University, Washington, D. C., second and fourth Tuesdays in each month from October to June, inclusive.

*Announcements must be received by the fifth day of the month in order to be published in the forthcoming issue of THE JOURNAL.

STATE SOCIETIES

April

Connecticut, at Stamford (15-17)

May

Illinois, at Peoria (12-14)

STATE BOARDS OF DENTAL EXAMINERS

California, at San Francisco, December 9. Kenneth I. Nesbitt, 450 McAllister St., San Francisco, Secretary.

Colorado, June 23-27, 1936. David J. Tepley, 807 Republic Bldg., Denver, Secretary.

Indiana, at Indianapolis, November 18-21. J. M. Hale, Mt. Vernon, Secretary.

New Jersey, December 2-7. John C. Forsyth, 140 W. State St., Trenton, Secretary.

Ohio, at Columbus, October 28. Morton H. Jones, 1553½ N. 4th St., Columbus, Secretary.

Wisconsin, at Milwaukee, December 9-13. S. F. Donovan, Tomah, Secretary.

STATE OF CALIFORNIA BOARD OF DENTAL EXAMINERS

The next examination to be conducted by the Board of Dental Examiners of California for license to practice dentistry and for license to practice dental hygiene in California will be held in San Francisco, commencing December 9, at Physicians & Surgeons College of Dentistry, San Francisco. All credentials must be in the office of the secretary at least twenty days prior to examination. Address all communications to

KENNETH I. NESBITT, *Secretary,*
450 McAllister St.,
San Francisco.

COLORADO STATE BOARD OF DENTAL EXAMINERS

The Colorado State Board of Dental Examiners will not hold a December session for applicants in 1935. The next ex-

amination for applicants for license will be held June 23-27, 1936.

DAVID J. TEPLEY, *Secretary,*
807 Republic Bldg.,
Denver.

INDIANA STATE BOARD OF DENTAL EXAMINERS

The next examination of the Indiana State Board of Dental Examiners will be held in Indiana University School of Dentistry in Indianapolis, November 18-21. Applications properly executed, together with college diploma and fee of $25, must be filed with the secretary of the board at least one week before the beginning examination date. For applications, instructions to candidates and any further information, address

J. M. HALE, *Secretary,*
Mt. Vernon.

OHIO STATE DENTAL BOARD

The October examination of the Ohio State Dental Board will be held at the College of Dentistry, Ohio State University, Columbus, the week beginning October 28. All applications must be in the hands of the secretary at least ten days before date of examination. For further information, apply to

MORTON H. JONES, *Secretary,*
1553½ North Fourth St.,
Columbus.

CHICAGO DENTAL SOCIETY MIDWINTER CLINIC

The Board of Directors of the Chicago Dental Society announce that the Society's Midwinter Clinic for 1936 will be held at the Stevens Hotel, Chicago, February 17 to 20.

GREATER NEW YORK DECEMBER MEETING

The eleventh Greater New York December Meeting will be held December 2-6, at the Hotel Pennsylvania, New York City.

GEORGE C. DOUGLASS, *Chairman,*
Press & Publication Committee.

AMERICAN ACADEMY OF RESTORATIVE DENTISTRY

The American Academy of Restorative Dentistry will meet in the Hunt Room of the St. Charles Hotel, New Orleans, November 2-3.

A. F. SCHOPPER, *Secretary.*

SOUTHWESTERN SOCIETY OF ORTHODONTISTS

The fifteenth annual meeting of the Southwestern Society of Orthodontists will be held at the Rice Hotel, Houston, Texas, October 31-November 2. An invitation is extended to all members of the American Society of Orthodontists to attend these sessions on their way to the Annual Session of the A.D.A. in New Orleans the following week.

HARRY H. SORRELS, *Secretary,*
1207 Medical Arts Bldg.,
Oklahoma City, Okla.

ARKANSAS CITY DENTAL SOCIETY

The annual prewinter clinic of the Arkansas City Dental Society will be held at Arkansas City, Kan., October 13-15.

H. G. GILLILAND, *Secretary,*
Arkansas City, Kan.

HISTORY OF SCHOOL OF DENTAL AND ORAL SURGERY OF COLUMBIA UNIVERSITY

Manuel M. Maslansky, 119 West Fifty-Seventh Street, New York City, is collecting material for a history of the School of Dental and Oral Surgery of Columbia University, and would appreciate the cooperation of the profession. As the Columbia school is a direct outgrowth of the New York College of Dental Surgery, which was established in Syracuse in 1851 and became extinct in 1855, Dr. Maslansky is particularly anxious to secure photographs of and information about the directors, faculty and graduates of this college.

The faculty included: Amos Westcott, M.D., D.D.S.; A. B. Shipman, M.D; Thomas Spencer, M.D.; R. F. Stevens, M.D.; Daniel Vandenburgh, D.D.S.; Ehrick Parmly, D.D.S.; Corydon L. Ford, M.D., D.D.S.; C. W. Harvey, M.D.,

D.D.S.; B. C. Lefler, D.D.S.; Homer Adams, M.D.; H. M. Fenn, M.D., D.D.S., and George E. Hawes, D.D.S.

Among the directors were: William Taylor, M.D.; J. C. Stuart, M.D.; Daniel T. Jones, M.D.; P. C. Samson, M.D.; James Foran, M.D.; M. M. White, M.D.; Charles B. Sedgwick, Harvey Baldwin, E. W. Leavenworth, John Wilkinson, George Geddes, the Rev. Henry Gregory, George F. Comstock and T. B. Fitch.

The only known graduates were W. W. Allport, 1853, and Edward Augustus Bogue, 1855, but undoubtedly there were others whose names have become lost.

Members of the profession are requested to send any documents or photographs in their possession, or any information, however unimportant it may seem, to Dr. Maslansky, who will photograph and immediately return any papers or pictures entrusted to him.

Dr. Maslansky would also like any pertinent information about the early days and personalities of the New York Dental School (N.Y.C., 1892), particularly photographs and histories of C. E. Audelfinger, Mrs. Margarita A. Stewart and George O. Webster, members of its first class.

F. D. I.

Professional Committee of Patronage: Professional associations subsidizing the Congress may be represented on a professional committee of patronage with the assent of the organization committee.

Official Languages of the Congress: The official languages of the Congress are English, French, German (all three obligatory) and Spanish or Italian as the reporter may choose. Other languages may be used with the consent of the presiding officer.

Organization of the Congress: The Congress will hold: (1) general meetings; (2) meetings of sections, and (3) demonstrations. An exhibition, held in conjunction with the Congress, will be divided into: (a) scientific exhibition (objects of scientific research of the last five years only are permitted); (b) oral hygiene exhibition; (c) documentation and education; (d) dental supplies exhibition.

General Meetings: The Congress will hold: (1) a general opening assembly, opened by the president of the International Dental Federation, who shall induct the president and officers of the Congress, and (2) a general closing assembly, during which the date and place of the next International Dental Congress will be determined.

ANNIVERSARY OF GERMAN DENTAL SOCIETY AND GERMAN ASSOCIATION OF DENTAL, MOUTH AND JAW SURGERY

The seventh anniversary of the German Dental Society will be held October 3-6 at Berlin. The chief subject will be prosthesis and dental technology. Especial value is set at this meeting on the demonstrations, which will be held in great numbers at tables at the University Dental Institute. At the same time, special sessions of the study clubs of the German Association of Dental, Mouth and Jaw Surgery will be held. Send announcements and requests immediately to the office of the Deutsche Gesellschaft für Sahn-, Mund- und Keiferheilkunde, Berlin-Schlachtensee, Heimstättemstr. 20.

PROF. DR. SCHRÖDER, *President.*

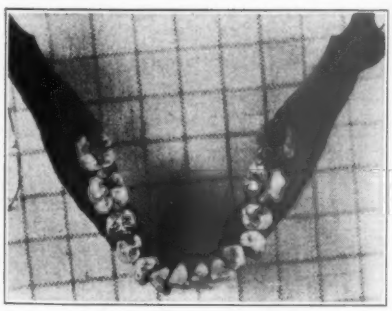
CAN YOU AID THE POLICE OF THE STATE OF VERMONT IN THE MIDDLEBURY TRAGEDY?

The accompanying photographs were received from Almo B. Franzoni, state investigator, of the State of Vermont, Montpelier, with the request that THE JOURNAL give them publication in a further effort to aid the police of the state in their attempt to identify three skeletons discovered near Middlebury, Vt. The following information was published in the July issue of THE JOURNAL, from a circular supplied by the S. S. White Dental Mfg. Co., May 28, 1935: You have probably read of the finding of three skeletons near Middlebury, Vt. One, of an adult, assumed to be the mother, and two children, probably girls. [Later information, from the state investigator of Vermont, identifies the skeleton of the larger child as that of a 14-year-old boy.] The death may have occurred two years ago or less. All victims bore bullet holes in their skulls. The only clue to iden-

tification at present is the orthodontic work in the mouth of the elder child. This is minutely described by Alfred P. Rogers, of Boston, in the May 21 issue of the *Boston Globe*. Further description of the orthodontic appliances follows: Upper: L Angles' large ribbon arch No. g-400 YA. 6 Angles' bands anterior No. G-430-XA. 2 Made up molar bands with 2 Angles' gold tubes No. G-460 soldered on. 2 Intermaxillary anchorage hooks placed opposite the mesial third of the cuspids have balled ends. Angles' lock pins No. G-453-A are used on the anterior bands. Lower: Lingual arch made of round 19-gage platinum wire, not Angles'. 2 Made up molar bands with soldered on half round tubes. Spring locks made of 0.028 wire. Dental work in the mouth of the supposed mother, while not significant for purposes of identification at long range, exhibited the high character of the child's orthodontic work. In cooperation with the police we are passing this information to orthodontists with the hope that some one may recognize his work from the description and establish identification. You are requested to communicate with Mr. John P. Conley, Attorney for the State of Vermont, Montpelier.

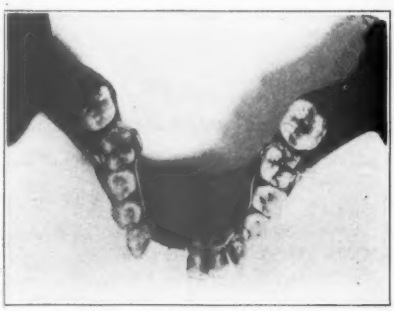
Skulls from skeletons found near Middlebury, Vt.

Upper jaw from adult skeleton, supposedly of mother.



Lower jaw from adult skeleton.

Teeth of older child, supposedly a 14-year-old boy.



Lower teeth of older child.

AMERICAN DENTAL ASSOCIATION

New Orleans, La. November 4-8, 1935.

HOTEL RESERVATION

In securing hotel reservations for the 1935 Session, consult the hotel rate-sheet and fill out the blank application below. Mail immediately to the hotel you wish to patronize. The hotel will then advise you of the reservation which has been made for you.

In case your first choice cannot be made, kindly indicate second and third choices. If none of your choices are available, the hotel manager will mail your application to the Chairman of Halls & Hotels Committee, who will make as favorable reservation for you as possible.

Please remember that a reservation constitutes a contract with the hotel to provide you with the accommodations you desire. If you find it impossible to carry out your part of the contract, namely, to occupy the room at the time agreed on, please write or wire the hotel, releasing the room reserved for you in order that it may be available to others attending the meeting.

MAIL THIS APPLICATION DIRECT TO THE HOTEL

HOTEL RESERVATION

AMERICAN DENTAL ASSOCIATION, NEW ORLEANS, LA., NOVEMBER 4-8, 1935.

.....Hotel.
New Orleans, La.

Please reserve sleeping accommodations as noted below:

.....Room (s) With bath for.....people. Rate desired per day $.....

.....Room (s) Without bath for.....people. Rate desired per day $.....

Second choice hotel..... Third choice hotel.....

ROOMS TO BE OCCUPIED BY:	ADDRESS IN FULL
Applicant.....	.....
.....	.....
.....	.....
.....	.....

Please confirm this reservation to applicant. I further agree to notify the hotel at once in the event I am unable to use this reservation.

IMPORTANT TO HOTEL MANAGER: In the event you cannot accept this reservation, please forward this application at once to Dr. G. O. Rosado, Chairman Halls & Hotels Committee, 827 Maison Blanche, New Orleans, La., who will attend to the assignment of this reservation.

HOTEL	WITH BATH		
	One Person	Two Persons	Twin Beds
BIENVILLE HOTEL Lee Circle	$2.00–2.50 3.00–3.50	$3.50–4.00 5.00	$5.00–6.00 7.00
DE SOTO HOTEL 420 Baronne Street	2.00–2.50 3.00–3.50 4.00	3.50–4.00 4.50–5.00	5.00–6.00 7.00
JUNG HOTEL 1500 Canal Street	2.50–3.00 3.50–4.00	5.00–6.00	6.00–7.00 8.00
LA SALLE HOTEL 113 Canal Street	2.00–2.50 3.00	3.50–4.00 5.00	5.00–6.00
HOTEL MONTELEONE 214 Royal Street	2.50–3.00 3.50–4.00	5.00–6.00	6.00–7.00 8.00
HOTEL NEW ORLEANS 1300 Canal Street	2.00–2.50 3.00–3.50	3.50–4.00 5.00	5.00–6.00
PONTCHARTRAIN APT. HOTEL 2031 St. Charles Avenue		5.00–6.00	
ROOSEVELT HOTEL 123 Baronne Street	3.00–3.50 4.00–4.50 5.00–6.00	5.00–6.00 7.00	7.00–8.00 9.00
ST. CHARLES HOTEL 211 St. Charles Street	2.50–3.00 3.50–4.00 4.50–5.00	4.50–5.00 6.00–6.50	6.00–7.00 8.00

YOUR visit to New Orleans is comparable to a trip abroad. The charm and appeal which have intrigued so many... its old customs, delightful manner of living and sense of hospitality... linger on. Yet, with it all, New Orleans maintains its position as a great seaport and its prominence as an industrial and commercial center.

Attend the ADA

What the meeting will mean to you.

A. Tonic for body and mind.
D. Rest when rest is needed.
A. Renewal of hope and enthusiasm

That is what the meeting will mean to you

The 77th Annual Session

of the

AMERICAN DENTAL ASSOCIATION

in NEW ORLEANS

November 4 to 8, 1935

CONVENTION

New Orleans Nov. 4-8. 1935

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1934-1935

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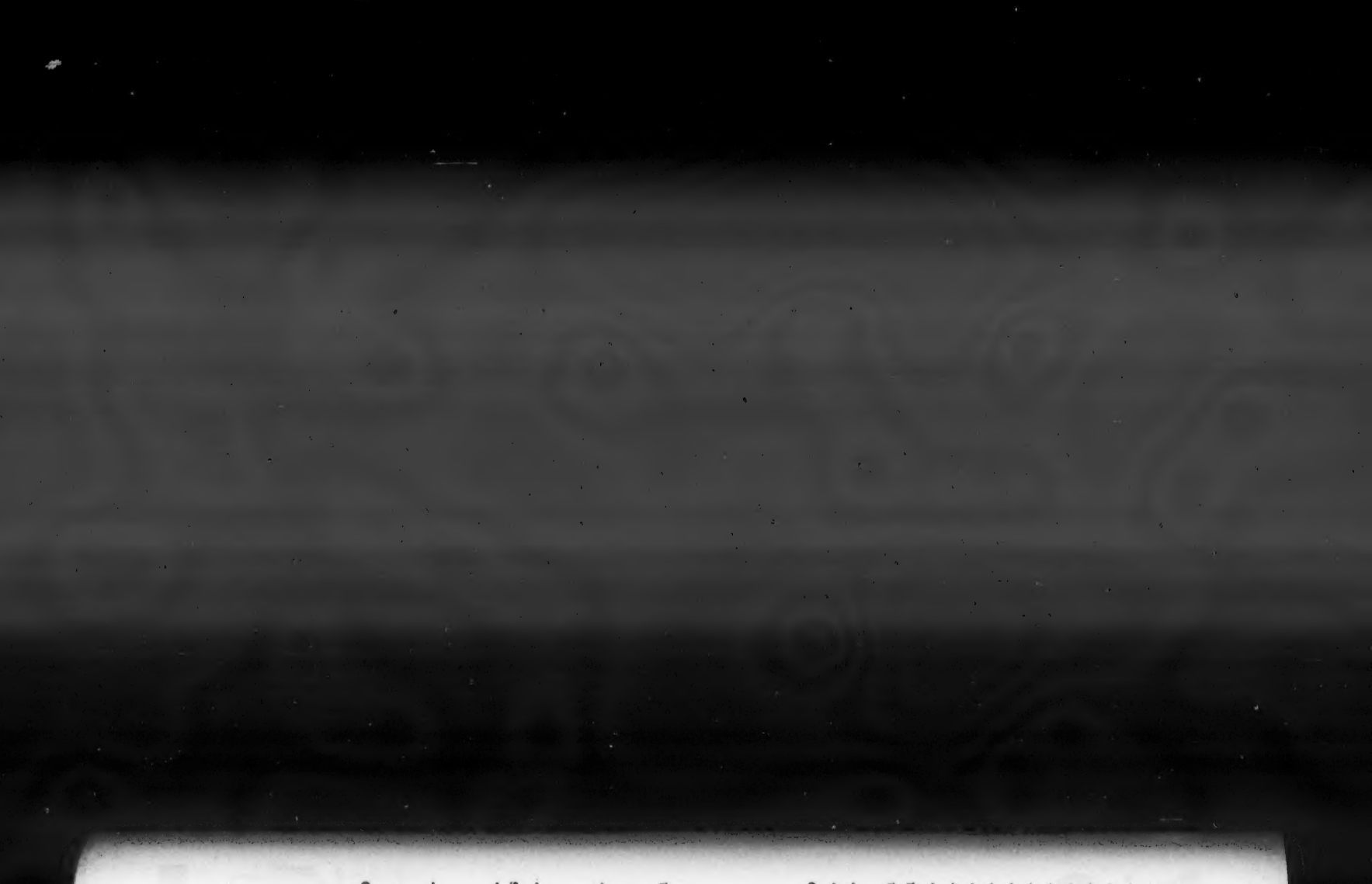
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